

May 11, 1929

A McGraw-Hill Publication

20 Cents per Copy

AVIATION

The Oldest American Aeronautical Magazine



SPECIAL FEATURES

PLANES THAT *Fly* OR PLANES THAT *Earn*?

SYSTEM AND ORDER IN THE *Stock Room*

THE *LeBlond Sixty* (MODEL 5-D)



Members of the Board of Directors of the Great Lakes Aircraft Corporation are shown in this photograph. The photograph is the property of the Great Lakes Aircraft Corporation.

Engineering.

IN the fast-moving days of small production in the aircraft industry, successful concerns have been built around the engineering ability of a single designer. The day is steadily here, however, when individual effort, be it ever so brilliant, must yield to superior force of numbers—when the narrow engineering department must be replaced by a group of trained specialists working in harmony toward a common end.

Great Lakes aircraft design, consistent with this Corporation's broad view of the commercial aviation field, owes its superiority to the coordination of such an engineering group. Great Lakes engineering problems have the benefit, not of one designer, but of many. Not of a few years of experience, but of close to a hundred. Designs of proven merit evolve easily and naturally from this wealth of experience and ability. Wings, fuselage, empennage, undercarriage, floats, power plant—each separate element of the projected whole has the undivided attention of a specialist in this particular phase of aeronautical engineering. The results, spelled out in terms of quality and performance, are daily writing new pages in aviation history.

GREAT LAKES AIRCRAFT CORPORATION CLEVELAND



No flying gravel or dust on firm, smooth Tarvia aprons



AVIATORS and airplane mechanics are quick to appreciate the firm, dustless surface of Tarvia aprons. On their taxing-up hands simply don't exist—propellers cannot whip up dust and gravel to do damage to the wings and motors of expensive planes.

Constructing a Tarvia apron is not likely to be difficult or expensive. All the 25-year old paving experience and country-wide service of the Barrett Company is available to the airport engineer.

Barrett engineers know how to utilize local materials to build smooth, dustless Tarvia aprons and efficient, skid-safe, all-weather Tarvia service roads and runways at a cost within the limits of any airport budget. And Tarvia maintenance—always easy and inexpensive—will keep them at the peak indefinitely.

The Tarvia field man will gladly give you all the details. Write, wire or 'phone our nearest office.

The Barrett Company

Chicago	Philadelphia
St. Louis	Pittsburgh
St. Paul	Portland
Seattle	San Francisco
Portland	San Jose
Portland	Seattle
Portland	Seattle
Portland	Seattle

In Canada
THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Tarvia
FOR ROAD CONSTRUCTION
REPAIR AND MAINTENANCE



**"It can't be done", said the
aeronautical world
... BUT FOKKER DID IT!**

WHEN Western Air Express, backed by the Georgetown Fund, proposed to establish the world's widest passenger artery between Los Angeles and San Francisco, their task laid down the equipment requirements which they believed necessary for a dependable and profitable operation.

The specifications called for an airplane combining high cruising speed, moderate landing speed, generous payload capacity, and other features of comfort and economy never before built into any aircraft.

All of America's best known airplane builders were asked to bid on the production of these planes. Some refused to even attempt to build such a ship. Some offered to attempt it, but without guarantee of success.

Fokker met the specifications—and guaranteed unconditionally to make them.

The Fokker F-7 is the result. It has not only met, but exceeded every one of the requirements. In a year of service for Western Air Express between Los Angeles and San Francisco, these ships have set absolutely perfect records. Western Air Express now operates 14 of them. Already more of these ships are in commercial service than any other plane of this capacity in the world.

They furnish added proof of what has been demonstrated many times before during the past twenty years... that Fokker design and construction set the highest standards known in the world of aviation.

OVER a hundred lines using Fokkers are Universal Airlines Corporation, Trans-Atlantic Transport, American Airlines, National Public Airways, Pan American Airways, Western Canada Airways, Dominion Airways.

FOKKER AIRCRAFT CORPORATION OF AMERICA

Factory: WHEELING, WEST VIRGINIA, and THUNDERBOLT AIRPORT, HARRISTOWN HEIGHTS, NEW JERSEY
Sales offices: NEW YORK OFFICE, 110 EAST 43RD STREET

THANK YOU for subscribing AVIATION



IT is impossible to forecast accurately the nature and volume of air traffic that will pass through and among our cities even ten or twenty years hence. We can only be sure that it will be tremendous—that the expansion of aerial transport from, say, 1930 to 1950 will be at least as great as the expansion of motor traffic between 1895 and 1915 and infinitely greater than the development of railroad traffic in the years from 1830 to 1850. Thus, in future, the economic destinies of our cities will be

bound to the air no less than to the land and water. The selection and building of air ports becomes, therefore, a matter of earnest necessity and one demanding most careful investigation. An inadequate or poorly located air port may, in incredibly short time, place a city at serious economic disadvantage. Every one of the technical factors—economic, geological, meteorological—bearing upon the utility of air ports should be analyzed. Moreover, the analysis should be made by experts.

Ford, Bacon & Davis, Inc.
Engineers

ESTABLISHED 1884

33 BROADWAY, NEW YORK

CHICAGO PHILADELPHIA SAN FRANCISCO NEW ORLEANS CHATTANOOGA

THANK YOU for subscribing AVIATION



Every phase of aircraft service covered by these batteries

Exide Aircraft Batteries designed to meet rigid flying requirements

OVER the ice wastes of the Arctic ... over endless stretches of ocean ... over cities, forests, mountains ... Exide Aircraft Batteries have proven their worth. Pilots have found Exides absolutely dependable under every condition encountered by any type of aircraft. That's why flyers choose Exide Batteries. They know them—they have confidence in them.

Specially designed for special service
Behind Exide is forty-one years' experience in building batteries for every purpose. Exide Aircraft Batteries were designed with the background of this

long experience ... especially to meet the rigid requirements of flying service. Forming, ignition, and radio power ... for navigation and landing lights ... Exide Batteries are constructed to give the maximum results. They are light in weight and the electrolyte cannot spill. They are *always* dependable. Write for full information on the various types and their applications.



Type CTK-150 recommended for night flying equipment

Exide

AIRCRAFT BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

Exide Batteries of Canada, Limited, Toronto
TRADE TON for identifying AVIATION

KEEPING PACE WITH THE TIMES



The time has come when the aeronautic expert, whatever be his field, is no longer the only qualified judge of aircraft quality for inquisitive American nature has resulted in a liberal education of the public in aviation. The surprising thing today is the number of men, women and even children whose airplane conversation runs to the simpler technical terms.

Spartan has recognized that to keep pace with the times the Spartan product must measure up to more than one set

of standards. The manufacturer has produced in the Spartan C-3 Challenger shown above, powered with the Curtiss-Challenger 170-horsepower motor, a plane in which the most discriminate expert and the most inquisitive prospect will find satisfaction plus.

The Spartan C-3 Walter, powered with the Improved Walter 130-horsepower, nine-cylinder motor, is another distinctive Spartan product. Details and specifications will be furnished on request.

SPARTAN AIRCRAFT COMPANY

~ Tulsa, Oklahoma. ~

WEAVE TON for identifying AVIATION

LUKE and FLUKE Luke Doesn't Like Competition

The CHALLENGER ENGINE Is Known for
Its Aerodynamic Efficiency

"It's A Good Engine"

the Challenger can be more effectively streamlined than the usual single-row radial engine. This is due primarily to the staggered arrangement of cylinders, plus the inherently low frontal area of a short-stroke, large-bore engine. These factors are largely responsible for the excellent performance of Challenger-engined airplanes.

CURTISS FLYING SERVICE, Inc.

New York Office—GARDEN CITY—LONG ISLAND

Sole Sales Agents for

CURTISS AIRPLANE AND MOTOR CO., INCORPORATED

CHALLENGER AIRPLANE CORPORATION CURTISS-ROBINSON AIRPLANE MFG. CO.

LLOYD AIRCRAFT CO. TOLSON AIRCRAFT, INC. COLUMBIAN AIRCRAFT CO.

"WORLD'S OLDEST FLYING ORGANIZATION"

THANK YOU for reading AVIATION

SIKORSKY
AMPHIBION

THE TWIN-ENGINE SIKORSKY AMPHIBION CAN FLY AND CLIMB ON ONE ENGINE WITH A FULL LOAD—IT IS THE SAFEST AIRPLANE IN THE WORLD.



CURTISS FLYING SERVICE, Inc.

New York Office—GARDEN CITY—LONG ISLAND

Sole Sales Agents for

SEABURY AIRCRAFT CORPORATION

CURTISS AIRPLANE AND MOTOR CO., INCORPORATED

ENGLAND AIRCRAFT CO.,
CHANDLER, INC.

"WORLD'S OLDEST FLYING ORGANIZATION"

THANK YOU for reading AVIATION

CURTISS-ROBINSON AIRPLANE MFG. CO.
LLOYD AIRCRAFT CO.



CHAMPION

the Better Spark Plug for every Aircraft Engine

Long superior whetstone spark plugs are of vital importance, Champion has now given to the aircraft engine a revolutionary new spark plug, based on over two years of research, experiment and testing. Designed and built exclusively to aircraft specifications and needs, the new Champion Aero-Spark Plugs duly bring a new factor of safety and dependability to an ever increasing number of aircraft engines.

Champion Aero-Spark Plugs are so designed that it is practically impossible to break them in such a way as to interfere with engine operation. Their ability to withstand tremendous pressures and temperatures is combined with the ability to withstand a maximum amount of oil.

Siliconized, nature's finest insulating material, which is exclusive to all Champions is used in both the primary insulator and the protecting "dome" insulator. Its superior strength and remarkable ability to withstand heat and electrical shock not only insure maximum safety against breakage at the terminal end, but also assures dependable ignition under all conditions at the firing end. These are special attributes of inherent design exclusive to Champion Aero types.

Although Champion Aero-Spark Plugs are a departure from standard design, they retain all the exclusive features of Champion two-piece construction, new gas-tight copper gaskets and special analysis high compression electrodes.

Exceptional care and the finest workmanship insures in Champion Aero-Spark Plugs the paramount requirements in aviation—safety and dependability. Install a set of Champion Aero-Spark Plugs in your engine.



Champion Aero Line Exclusive Features

- | | |
|--------------------------------|--------------------------|
| 1—Spring/Retard cap | 8—Lead Copper end |
| 2—Insulated analysis electrode | 9—Upper copper gasket |
| 3—Washer | 10—Primary insulator |
| 4—Air Cooling vane | 11—Shell |
| 5—Secondary dome insulator | 12—Lower copper gasket |
| 6—Dome gasket | 13—Main Gasket |
| 7—Insulator | 14—Flow-Ground electrode |

Outstanding World's Records Made With Champions

Altitude—38,751 feet, December 28, 1937—Major Harold G. Gatty.

Speed—218.69 miles per hour, March 1938—Major Harold G. Gatty.

Women's Altitude Record—22,500 feet, December 8, 1938—Louise McPherson Tholen.

Women's Endurance Record—Twenty-six hours, twenty-one minutes, thirty-two seconds, April 24, 1939—Elinor Smith.



Man, how that Ryan PERFORMS!

Straight ahead, a row of seven. Second then, high tension wires. Who cares?

With a whirr like that of seared quail, the Ryan takes off in a short 235 feet, eight seconds of time.

Hold your soap watch and watch her climb. In one turn of the motor band, an altitude of 3,000 feet. Up and up goes the Ryan until a five-foot speed disappears in the blue. A service ceiling of 18,000 feet, a top speed of 21,000 feet—works for other cabin ships to select at.

Now she noses down, straightens out and flies as the crew flies. At my cruising speed of 120 miles an hour, a top speed of 140. Speed is unlimited. Because of what it does in it, Ryan is the ship for you.

Just as Lindbergh's Spirit of St. Louis was in a class by itself, so this Stearman stands out in its field.

In ease of handling, stability and accuracy of control, the master of every situation, the perfect servant of the man at the stick.

"Bud" Hargrave at the factory, or any Ryan distributor will demonstrate these facts. We hope you're from Missouri, that's where Ryan lives.

On performance alone, Ryan built and sold in 1938 more Warbird cabin ships than any other maker.

Early deliveries of latest model, the new Ryan Brougham for Six, are now being booked. Write for illustrated catalog. The Mahoney-Ryan Aircraft Corporation, Louisville, St. Louis Airport, Oakland, St. Louis County, Missouri.

The New RYAN Brougham—Ritter Ship of the "Spirit of St. Louis"

Present representation includes these leading distributors

Burns Aircraft, Inc., Albany, N.Y.	Albany, N.Y.	Central, Ky. Albany, N.Y.	Chicago, Ill. Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.

FOREIGN

Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.
Albany, N.Y.	Albany, N.Y.	Albany, N.Y.	Albany, N.Y.

The MAHONEY - RYAN AIRCRAFT CORP.

London-St. Louis
Airport



Albany, St. Louis County
Missouri

NATURALINE SPEEDS THE UNITED STATES MAILS



New York
Philadelphia
Washington
Richmond
Cleveland
Spartanburg
Atlanta
Jacksonville
Miami
Tampa
Birmingham
Mobile
New Orleans
Houston
Dallas



from NEW YORK to MIAMI-HOUSTON

Naturaline functions just as uniformly in the North as it does in the South, climate makes no difference.

PITCAIRN AVIATION, INC.

Mr. James G. Ray of Pitcairn Aviation, Inc., wrote to us in appreciation of Naturaline, as follows:

"We have been using Naturaline on our New York-Albany route for several months and find it very satisfactory. We find that our motors run considerably smoother than they did on domestic aviation gasoline and that they develop about 25 to 50 more revolutions. Also gas consumption is running low per hour—your distribution has made it possible for us to procure Naturaline at a very reasonable price."

Pilots flying these mail routes can always depend on securing Naturaline at these mail stations.

GOULD AIRLINES, INC.

Mr. Wm. H. DeWald of the Gulf Air Lines wrote to us in appreciation of Naturaline, as follows:

"We have found that our motors run much smoother on Naturaline than on the regular domestic aviation grade of fuel and also that they run cooler, which is a very important factor in this warm country. These features, coupled with the fact that it weighs one-half pound per gallon less than specification gasoline influenced us to adopt Naturaline for use on our lines and our experience with it to date has been very satisfactory from every standpoint."



Naturaline starts a cold motor quickly. Naturaline is a perfectly balanced fuel. Naturaline is uniform at all times.

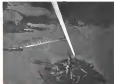
Naturaline weighs 14.46 per gallon less than ordinary domestic aviation gasoline.

Naturaline will increase the B. P. M. from 10-15 depending upon type of motor.

Naturaline saves in fuel consumption from 2-12% depending upon type of motor.

Naturaline has an anti-knock value equivalent to 48° anti-knock.

Naturaline will reduce motor overhaul costs.



NATURALINE



NATURALINE
Company of America
Cleveland 67 Smith Bldg.
Tulsa, Oklahoma



PLEASE TOLL for mailing AVIATION



"Rank among the best" writes Stinson Aircraft Corporation

"We have completed a series of tests on Sherwin-Williams Aircraft Finishes. The Sherwin-Williams Dope and Airplane Lacquer Finishes we have found to rank among the best we have found on the market today. Your DuPontsman Primer has also passed our tests for aircraft use. "We had excellent results in recommending these products to airport painting as excellent finish and a durable quality."

Very truly yours,
Stinson Aircraft Corporation
Rm. 21 Jackson, Dept.

Note the writer's words "ranked first" and "durable quality." Permanent maintenance of aircraft have been quick to adopt the complete line of Sherwin-Williams Aero Finishes for these very reasons. The knowledge acquired in sixty years of making face finishes—the best of scientific skill and research facilities—new materials of finest quality—

all these have been called upon to perfect these famous "quality" finishes. The Sherwin-Williams line is complete—it includes protective coatings, dopes, varnishes and lacquer enamels. They insure maximum protection—are light in weight—offer the highest degree of beauty consistent with serviceability.

Increase visibility of planes

Important! Our skilled colorists will aid you in increasing the visibility of your planes by means of light reflecting colors, enamels, etc. Visibility is an important safety factor that pilots, owners and manufacturers must consider. This service is gladly given. Write us for more details on these new, sensitively correct aero finishes.

The Sherwin-Williams Co.
Cleveland, Ohio

SHERWIN-WILLIAMS AERO FINISHES

For planes, hangars and equipment

SHERWIN-WILLIAMS CO., Dept. 161, 654 Grand Blvd., W. W. Cleveland, Ohio
Please send me complete details on Sherwin-Williams Aero Finishes.

Name _____

Business title _____

Address _____

State _____

City _____

Post _____

PLEASE TOLL for mailing AVIATION



REFINEMENT OF DETAIL

WHEN flying becomes a business, good performance and an adequate factor of safety are not enough. Equipment must be capable of continuous operation with maximum reliability, minimum upkeep and with the least possible charges for depreciation, maintenance and repair. The consideration given these factors in the design of Knoll aircraft has been as thoughtful as the consideration given to performance. Makeshift construction has no place in the airplane which must operate at a profit.

The KN-1 is the product of an engineering staff of long experience and thorough training. It is built in a factory with every facility for quality production by an organization that believes the future of flying depends on machines which can be operated to show a profit.



Mr. KNOLL
AIRCRAFT CORPORATION
475 West First Street
WICHITA, KANSAS

THANK YOU for watching AVIATION



THE problem of to-day's aviation motor manufacturer has changed.

A high number of motors are required by the many new planes now being made.

This is the production stage, and a great deal of thought on the proper handling of the various units going into such motors is of utmost importance. The present plant facilities of S. Cheney and Son plus their twenty-five years' experience in the manufacture of air-cooled cylinders are readily available to a motor manufacturer facing a production problem. Your inquiries will be given immediate consideration and definite plans for production following your specifications will be clearly outlined by a competent engineering staff.

WRIGHT

The Wright Gypsy Cylinder is now manufactured under production methods and other outstanding motor manufacturers are using Cheney Cast Cyl-



GYPSY

inders to good economic advantages. Cylinders can be furnished either rough or machined to the specifications of any responsible manufacturer.

S. Cheney and Son
AIR-COOLED
MANHUS, N.Y.

THANK YOU for watching AVIATION

THE AMERICAN CIRRUS MARK III

simplicity the Key to Confidence



Three-quarter rear end view

Equal in importance with the extreme reliability of the American Cirrus Mark III is its simplicity of construction. Built to a well-known and conventional design, its operation is easily understood by a student or private flyer. The engine in its simplicity, creates a confidence in the pilot to control and maintain it as he has already controlled and maintained his automobile engine. This confidence is invaluable to any pilot, especially the amateur. It lends itself to top or complete overhaul with a minimum of cost and no further skill is needed for the care and maintenance of the engine than that required for the engine of a motor car.

AMERICAN CIRRUS ENGINES, INC.

WASHINGTON AVENUE, ELLEEVILLE, N. J.

THANK YOU for reading AVIATION

IF Engines

that reflect Accuracy in its highest POWER

Axelson Airplane Engine
Developed by J. H. Axelson
Copyright 1929

PERHAPS as the head of the pilot is the trustworthiness of his Engine—for a day is no better than its engine. And in fact, an engine is no better than the degree of accuracy with which each part is manufactured.

Axelson Airplane Engines are the product of 35 years' experience, focused in one organization, engaged in the art of fine tool making and precision mechanical manufacture.

During these 35 years Axelson has produced many millions of dollars' worth of fine tools and mechanical products, such as heavy-duty precision lathes, gauges, finely finished oil well pumps, and other works requiring a knowledge of the most advanced methods of metal analysis, heat-treating, precision measurement and testing.

It was but a logical way for Axelson to develop this special experience and focus it in the development of airplane engines that would demand no greater and cheaper quality as such as the Axelson lathes and oil well equipment in their respective fields.

As a result of years of research and study, supported by the finest and successful experience of the organization, a complete series of radial, or radial engine is offered. It is unsurpassable in the most advanced methods of engine design, analysis, construction, development, the highest labor power of any engine of similar size and involving great experience, science, particularly in its method of lubrication.

Ask for Literature

Axelson Machine Company

Factory and General Office
Corner Randolph St. and Boyle Ave.
Los Angeles, California
(P. O. Box 121)



AXELSON AIRPLANE ENGINES

THANK YOU for reading AVIATION



WACO "165" STRAIGHT WING

WACO with the new J-6, 5 cylinder Wright "Whirlwind" motor... Brilliant performance with astonishing smoothness... Top speed of 125 and better... Excellent maneuverability... Exceptional climb... In and out of the smallest fields with ease... That's the WACO "165" Straight Wing. It's the airplane many have been waiting for.



"ASK ANY PILOT"

We are preparing a book about the formation of Flying Clubs. If interested, we suggest that you reserve your free copy now.

THE ADVANCE AIRCRAFT COMPANY, TROY, OHIO
WACO TOE IN "Whirlwind" AVIATION

EQUIPMENT

J-6 Wright "Whirlwind" motor
 165 H.P.—5 cylinder
 Wood propeller
 Bendix Brakes
 Navigating equipment
 65-gallon gas tank
 3-place... Dual controls
 Customer's choice of colors

\$8370

(With wood propeller \$75 additional)

For these details on request



AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

May 11, 1929

Vol. 12, No. 11



Useless Predictions

THE STATUS QUO of the aeronautical industry in the future is a subject which is becoming quite popular among "after dinner" speakers on aviation. As a matter of fact that is a very good subject, for one man's guess is just as good as another's. And guessing they are, particularly the newcomers into the field and the publicity hunting gentlemen who ten years ago would have flown in an airplane only at the point of a gun.

Far be it from us to imply that the newcomers such as bankers, investment brokers and capitalists of other industries, etc., are not welcomed with open arms by the members of the original aeronautical industry. There is much need for their brains, their ability, and, of course their money. They will prove of incalculable value to the development of aviation and the development of aviation will undoubtedly fully reward them.

However, five years ago the industry did not predict the era of 1927, and today the industry cannot predict the era of 1935 or 1940. Instead, it is struggling toward a satisfactory solution of immediate problems, and planning what it can for tomorrow's task. This procedure, we believe to be far better and far more helpful than advising the world at large that the future aeronautical industry will be comparable to the massive industry of the motor boat industry, etc. Perhaps it will be, and then again, perhaps it will be an industry all its own and one without a criterion.



Shoestring Developments

HOW MANY TIMES have we heard the statement: "I could see this airplane into production if I only had a few thousand dollars." It would be difficult to count them, and each time we have felt that if the speaker did not get his few thousand dollars it might be better for the speaker, the airplane and the industry.

When prospective aircraft manufacturers, in estimating their financial requirements, assume that the cost of building one or two airplanes and equipping a small

factory is sufficient, they are almost inevitably courting ruin. Every successful airplane has been built up on a series of failures, and failures are expensive but necessary. And many promising designs have been shelved because of improper financing. This is also true of airports and airport enterprises.

If you have a good design and lack financial backing it would probably be better to sell it to someone who is in a position to produce it than to attempt it yourself. If you do attempt it, be sure to employ a financial "safety factor" sufficiently high to provide for the unforeseen failures which are inevitable.



Airport Restaurants

IN EUROPE, many persons amuse themselves on a holiday by visiting an airport where they remain all day, watching the planes land and take-off. Comfortable seats under shade are provided for them, and, in many cases, luncheon is served. The airports have been made attractive so that they have become gathering places. As a result, the landscape is becoming more and more attractive. The airplane, so long, will soon offer the only logical means of going from one place to another.

In the United States, a few of our air transport companies have endeavored to follow the example that has been set by Europe in making the airport attractive. They have erected passenger stations where the spectator may view the plane movements on the field in comfort, and they have provided restaurants where a real meal may be obtained. However, in the majority of our airports, the spectator—the prospective passenger—has been entirely ignored. Most of the airports cannot even boast of a place to eat. True, there are "hot dog" stands, but nothing more. If the spectator wants a real lunch, he usually has to go out to get it. Therefore it would seem that airport operators, even if only for their own comfort, would not to it the adequate restaurant facilities are provided. In actual fact, the granting of a restaurant concession should bring the airport operator a return of from 40 to 60 per cent of the gross receipts.

CONSTRUCTING A Dustless AIRPORT

ONE OF the most interesting features announcing the Grand Central Air Terminal at Glendale, Calif., which was opened to the public early this year, is the success of the dust abatement methods employed there, particularly on the 300-ft. 900-ft. landing strip where a 6-in. depth of firm but cushioned surfacing has been waterproofed and rendered dustless at a cost of about 7 cents per sq ft.

The site for the field was chosen because it is only 15 min. by automobile from the Los Angeles City Hall and is situated in a wide, sheltered valley, where the winds are reported to blow in an up-valley direction 90 per cent of the time. Since most of the take-offs would be made, naturally, in one direction, the runway was located accordingly and was built of concrete 72 ft. wide and 3,000 ft. long, with provision for ultimate extension to 4,000 ft. The total runway width was brought up to 92 ft. by adding 20 ft. of 3-in. asphalt paving on either side of the concrete.

The concrete is 6-in. thick at the edges and 5-in. in the center. It consists of a 1:1:2½ mix, without reinforcing, has dummy transverse joints every 35 ft. and full expansion joints 400 ft. apart. The paving was laid in three 24-in. strips poured alternately.

In addition to the main runway and connecting with its north end, there is a concrete paved taxiway extending along the east side of the airport, leading directly to the passenger terminal and adjoining it in front of the hangars beyond. The width of the taxiway from hangars to runway is extended by a 20-ft. width of 3-in. asphalt concrete on either side. Twenty-foot taxiways of 3-in. asphalt concrete are laid on the north and west sides.

In order to conform to the requirements of the Department of Commerce for two take-off runways intersecting at an angle of not less than 90 deg., construction is to begin in the near future on the second concrete runway which will be 3,500 ft. long. The ground at the site had a general slope of about 6 in. per 100 ft. toward the Los Angeles River, and when construction of the airport was begun the first operation was to work over the surface with Fresno and all low spots had been filled in and a smooth, uniform slope was secured so that



An air view of the Grand Central Air Terminal, showing the concrete take-off runway and the landing strip, which parallels it.

surface water would run off readily toward the river.

For dust abatement over the field generally, a single application of a special grade of road oil having 60 to 70 per cent asphalt content was made under pressure and with oil at a temperature of 180 deg. F. About 4 gal. per sq ft was applied in this way, securing an average penetration of from 4 to 1 in. Before making the oil application it was found important to have the surface smooth and well compacted on a uniform grade.

Approximately 657,000 sq ft treated in this way has been found to remain dustless, although, where distrib-

How the Dust Problem Was Eliminated at the Grand Central Air Terminal, Glendale, Calif.



Spreading the oil on the landing strip with road graders to secure the desired adhesion after the filling and leveling.

ance of the surface is caused by non-olive bindings or by high speed landing, occasional light maintenance is required. It is expected that the entire area may require a reapplication of this penetration oiling after a period of service of from perhaps six months to a year, according to the amount of rough usage.

In contrast to this light oil application for dust abatement, the landing strip, which parallels the concrete runway, was prepared with much more chlorastic treatment to secure an area that would not be damaged even by the roughest landings. In this area, the objective was to get a firm but resilient waterproof layer of soil 6-in. thick. This depth is more than two thirds will penetrate, and this rough usage will not make openings through which water can reach the subgrade.

A SOIL ANALYSIS showed the surface material to be an admixture of silt and sand of a very fine-grained nature. In fact, it was so fine, that to have applied oil without first working in corner material would have resulted in a thin crust of soil and oil which would not have lasted long, because of the high percentage of silt and the abhorrent quality of the very fine particles that are said to shorten the effective life of oil. This is just the opposite

effect to that produced by admixtures of oil and sand: the individual sand grains do not absorb oil, but, instead, are said to support and preserve its natural qualities.

Laboratory experiments were made with various quantities of sand in combination with sieges of the silt, all based on the objective of a 6-in. layer of the admixed materials. A 3-in. layer of sand worked up with silt to give a 6-in. layer, resulted in a mixture such that 4 gal. of oil per sq ft was required to produce the plastic qualities desired. The maximum of efficiency and economy was found with a 6-in. depth of sand to which was added enough silt to bring the layer to a 6-in. thickness. This combination required only 3.2 gal. of oil per sq ft.

Based on this determination, enough concrete material was dumped on the 300-ft. 900-ft. landing strip, so that when spread by Fresno and succeeded off with a

light drag it gave a uniform sand layer 4 in. deep. The entire area was then diluted to a depth of 6 or 7 in., thus making thorough in the sand and cutting 2 to 3 in. into the silt. Finally the light drag was used over the entire area once more and the job was ready for oil.

The oil used on the landing strip was a non-flashed product of 60 to 70 per cent asphalt content whose 80 penetration modulus was not more than 80 per cent soluble in petroleum ether. This oil was applied from pressure trucks at temperatures of 180 deg. F. The oil was put on in four or six applications, and the entire area was diluted after each application. It was found that the maximum amount of oil that could be absorbed to advantage in each application was about 4 gal. per sq ft.

The full amount of oil prescribed was put on with only the light harrowing between successive applications. No drag was used in this operation. After the oil application had been completed the surface was worked repeatedly with road graders so as thoroughly



Oil harrowing the surface of the landing strip at the Grand Central Air Terminal after an application of oil.

being added when necessary to maintain tension in the wires under the action of air forces on the model. The frame is restrained from downward movement by flexible links, attached to either side of the frame, which, through bell cranks transmit the restraining forces to two other balance beams. The sum of the forces acting on these beams is, of course, equal to the drag, while the difference between them times the distance between the links is equal to the yawing moment. The tail lift is measured by the sum of the forces on the three beams supporting the frame while the pitching moment is obtained by a combination of lift and drag forces. As the air lift balance has over the yaw and a greater bias of the tunnel, and frame and the downward pair are displaced laterally from the center line, the rolling moment is calculable from a knowledge of the distance between the forward points of support and the forces on the two forward lift balances. The frame is restrained from transverse motion by a single link which indicates the cross wind force directly. Counterweights are used to apply equal tension to the drag and cross wind force systems.

With this type of balance, it is necessary for the calculation of moments to have accurate knowledge of the position of the model with respect to the balance scale. For this purpose, a special telescope, equipped with a carriage and scales for vertical and horizontal motion (the latter along the stream direction), is mounted alongside the tunnel duct on a concrete pedestal which runs upon the building floor. The cross hairs in the telescope are brought into register with a mark on the model for the ending of position. The telescope also is capable of reaching about its optical axis and is provided with a graduated circle for the measurement of angles. The sighting of one of the cross hairs with a line on the model thus serves to define the scale of pitch.

The propeller testing apparatus consists of a combined torque and thrust dynamometer mounted upon a movable carriage which can be moved by a portion of



A general view of the open duct, 30-in. type wind tunnel at Stanford University.

the cross wind mechanism, be moved into or out of the wind stream. The dynamometer itself is of the electric crank type, but is mounted on elastic knife edges rather than in the usual ball bearings. As these knife edges are necessarily below the shaft, a pendulum counterweight is required to bring the center of gravity of the assembly below the line of knife edges. The dynamometer actu-

ally consists of a special short-mount three-needle meter upon one end of which has been built a long and aluminum housing enclosing the propeller shaft. A special coupling fitted to the motor shaft makes it possible to transmit torque to the efficient propeller shaft, which is free to spin freely. The torque required to drive a model propeller is measured by exactly the same method that is used in the testing of an engine on a electric dynamometer, i.e., by measuring the tension of the dynamometer shaft by a simple beam balance. The thrust of the propeller is measured by another balance, which is connected by a linkage to a ball bearing race riding on the front propeller shaft, thus transmitting its axial motion under the action of the thrust. The thrust balance is damped by a vise and damped at the end of the balance beam. Torque damping is provided by a similar construction at the lower end of the counterweight pendulum.

FOR THE DETERMINATION of propeller characteristics, the necessary data are thrust, torque, air speed and density and propeller speed. Thrust and torque are measured directly as described above. Air speed is calculated from knowledge of the pressure reduction in the diffuser chamber and the air density. To do the latter, barometric and barometric pressure are required. The propeller speed is obtained through the use of a two-pulse tachograph. One pin is actuated by a clock pendulum, while the other receives an impulse at each fifth revolution of the test propeller. This impulse is provided by a single magnet commutator connected by a wire to the dynamometer shaft.

The measurement of balance room pressure reduction used for the determination of air speed, is accomplished through the use of a balance room the front of which hangs two inverted bell pans, whose open ends lie beneath the surface of a tank of kerosene. Vertical tubes lead to the interior of air volume within each bell pan; one tube is open to the diffuser chamber and the other passes through the chamber wall to the main tunnel room.

The difference in pressure measured by this balance is somewhat greater than the dynamic pressure of the wind stream, because a certain amount of the total pressure energy is expended in overcoming a wall friction. It has been determined, however, that this pressure reduction bears a constant ratio to the dynamic pressure, unless the air stream is obstructed by some very large object. Under this condition, the reduction of pressure at a certain point of the intake can be used as an index of the air speed.

The velocity of the air stream is sufficiently constant without any form of speed regulation other than that provided by the independent power supply for propeller driving and motor testing of the wind tunnel. The regulation is not sufficiently close, however, for quantitative experiments on stationary models in which the highest degree of experimental accuracy is necessary and for this purpose a special form of regulator is being developed.

It may be of some interest to those concerned with aerodynamic research to learn the relatively small cost of the equipment described above. In the present instance, very after the wind tunnel has been prepared for the interior structure which it was to receive, the cost of the apparatus placed therein, including test structure, honeycombs, propeller shafting, drive motor, motor-generator sets, aerodynamic balance, propeller dynamometer, etc., actually totals less than \$15,000.

Engineering SECTION OF THE AERONAUTICS BRANCH

By DONALD E. KEYHOE

AS INDICATED by the preceding article registration is the most important work of the Aeronautics Branch of the Department of Commerce, although it receives only a small percentage of the entire appropriation for the Branch. Most of the money goes to the Aeronautics Division, which operates through the Bureau of Lighthouses, but is under immediate direction of the Assistant Secretary for Aeronautics, and the Director. At first thought the Aeronautics Division might be considered the most important unit, but such is not the case.

Major Clarence M. Young, director of Aeronautics, recently made a statement bearing on this although not in any discussion of the relative importance of the divisions.

"One-tenth of civil flying is on schedule over the country," he said. "The rest is uncoordinated flying, including advertising, mail work, student training, advertising, crop spraying, and a sort of other operations along with private flying. The air work of great importance to that one-tenth, and to a large degree to the rest of the industry, as air transport has been the backbone of commercial aviation. But without licensed pilots and licensed planes to fly over them, the airway would be of no value."

"They might have the latest in business, radio-aided, field, and radio, weather observing stations, communication service, and every other facility, but without airworthy aircraft and competent pilots flying in conformity with standard air traffic rules, there would be chaos. To prevent airway operations, the one-tenth—there is possible danger from part of the other 90 per cent, regulations are vital."

So the Regulation Division comes first in the Aeronautics Branch, and is considered first by the members, even though the Aeronautics Division gets the lion's share of the appropriation to cover expenses of business, promotion and upkeep of fields, and certification and maintenance of radio aids and communications.

The Regulation Division was organized late in 1926 by Theodore Young—then chief of that division. There were absolutely no precedents to follow. The Air Corps men, Regulations were written after careful consultation of the newly and co-operation with those to be governed. The Division is now headed by Edward H. Howard, who is a major in the Air Corps Reserve and as authority on commercial work. The unit comprises three sections: Engineering, Licensing, Inspection, Medical, Statistical and the Aeronautics Section Board.

After two years of operation, it might be expected that this division should be settled into regular, constant operation, and that any and all problems could be solved by ready reference to various cases, decisions, and so forth. But here it has not really happened.

At the start, Bureau Secretary MacCadden and Major Young said emphatically: "No prior aviation." The first pilots obtainable were secured for inspectors. The field was secured for capable engineers, of which there was already a shortage. Even so "cock jobs" not requiring flying experience, men with flight training began to appear. Their knowledge helped. The total result was teamwork of a fine order. The staff was new; it tilted the game. It rolled up its sleeves and enthusiastically started to work.

But hardly had it begun when the industry awoke to the value of these men, particularly the veteran pilots and engineers. It wanted until they had acquired a good understanding of the Department's ideas and policies—and then sang its own song. And who could blame pilots or engineers for adopting attitudes which came from "the center"?

The Department did not make any attempt to hold them against their will: not one man has ever been regarded to stay when he strongly desired to leave. Chiefs of divisions and sections have simply signed and started looking for replacements, knowing the same thing would happen all over again.

The turnover has been tremendous in the past two years. Nor will the situation be any better for some time. The effort has been well and is unfortunate. The few individuals who have remained as heads of organizations appear to have lost their offices—and themselves as an interesting position. A case comes up, something which is used Government offices would be turned over to "Old Trinity," who has handled just such cases before. But the Chief of the Registration Division, for instance, cannot push a button and dispose of the matter so easily, for the simple reason that the "old trustees" are few and far between. Just about the time a valuable has been turned enough to take over minor details and perhaps a lot of more important, he resigns to take a better position with the Army—Manufacturing Co. or with the Bureau of Transportation.

So the keys to the fast-changing, complex picture are

held by less than six men in the Department of Commerce.

Those "less than six" must carry in their heads the answers to a thousand and one minor questions instead of being free to concentrate on major problems. All this added to the breaking up of new men at too-frequent intervals.

Perhaps in the future the loose, casual, active type now directing the Department's aeronautical work will be replaced by more professional, dedicated officials who will periodically consult Page 96, Volume 11 of "De-Quibus and Cuius" or some other guide covering any and all situations that may occur. It will not be for some time, however, because those now making the decisions haven't enough time to get their controlled men personnel to do the compiling. And a careful search will fail to disclose any phlegmatic officials at this time.

The "bureaucratic" situation, resulting in only a few men being left with sufficient experience to make important decisions, has been and is responsible for much of the criticism from the industry. Sometimes, oddly, it is the company that takes a step from the Department that suffers because certain work is held up when it is a result of that very same being taken away!

Much of the industry's criticism has been directed at the Engineering Section. This is only natural, because this section controls the first step in the licensing of airplanes.

A COMMERCIAL decision to build an airplane. It seems almost backing, build or lease a factory, engage engineers and place its product. Sometimes it builds the first plane—before it comes to the Department of Commerce to learn whether its plane will meet licensing requirements. A few manufacturers have even started production at the very time that they submitted their stress analysis, drawings and other necessary papers to the Engineering Section, apparently expecting approval-type criticism in the form of a letter.

There are about 170 listed airplane manufacturers in the United States. Some of these are manufacturers in name only, but the many large companies make up for them. It is safe to assume an average of at least two engineers per airplane manufacturer, because of the large number in the larger organizations. That means at least 340, and probably over 500 engineers who are frequently in correspondence with the Engineering Section about new designs, changes, safety equipment or other matters.

Then there are engine manufacturers and builders of propellers, safety equipment, and other accessories, some of which are to be certified by the Department.

Consequently, there are about one hundred men constantly before the six engineers who make up the Engineering Section. And every one of the manufacturers or engineers behind these hundred eyes waits on speed, pointing frantically to delayed production, overhead from idle facilities, and serious financial losses.

Six against three hundred and forty. The ratio should be embarrassing. Not that the Engineering Section is ever "baptized" any one, or any organization, in spite of many complaints from the industry. Most of that has

The "old" force to handle the volume of business is only one factor. At the outset, in order not to build up production of planes or otherwise hamper the industry, the most simple engineering rule was adopted by the Department. There is change behind that: the manufacturers were warned, as a rule, and that they would naturally see good practices and keep safe in the fore-

W. H. MacCracken, Jr.,
Assistant Secretary of
Commerce for
Aeronautics



ground in order to gain the best possible reputation and express the public with the dependability of their products.

At that time there were few manufacturers who would not have subscribed to the theory. But when the lesson came it became surely a theory, for it was inevitable that shapers should appear in this recent field for making money quickly. The "house system" didn't work at all with them. The first single rule had left numerous loopholes or points where the Department believed manufacturers would use different methods of construction and correct material. The department issued an entry point where money was to be used, even though that money saving meant unsafe planes.

"The regulations don't cover these matters," they reported when questioned by the Engineering Section. "We can do what we please."

The immediate result was a let-down in quality of some products, fortunately in the minority, but sufficient to cause a few dramas and thereby lower public confidence. The Department was forced to revise the code and it is still revising it. From time to time, in order to keep the unscrupulous manufacturer from getting "beyond the law" with a dangerous plane.

The rule is too large, but not of the Department's shooting. It causes the Engineering Section as much trouble as it does the industry. For it takes more time to check and approve which should be a simple, routine practice. And it keeps at least one engineer busy working on changes to keep up with the eager makers for loopholes.

The burden of placing commercial airplanes safe has been squarely placed on the Department of Commerce. Of course, there are builders who would not consider inferior material or questionable methods for a moment. But the percentage of planes in which serious flaws have been found is surprisingly large. Even a few of the sleek manufacturers have tried to "get by" and this has been the general rule with the private industry. This same tendency has been found in other fields. At first the Engineering Section carried out only ordinary tests, until a series of crashes to certain types of planes forced reexaminations. Now all new designs are "given the works." The tests are as strict as those given planes proposed for Army and Navy use, although naturally they are not expected to have similar performance

These flight tests have disclosed some strange conditions—planes that would at critical points where they should be inherently stable, that are tricky, that get two spins easily—and they there! That is until they hit the ground.

A Department with a hard-headed attitude could not allow these people a chance to reach the market. It would have grounded them at once, broadcast the damning report "Unsuitable" throughout the industry and several manufacturers today enjoying comfortable sales would have been ruined overnight. Not that the Department has permitted such a thing to continue, for that would have been criminal negligence. But its policy has been admirably fair and lenient.

From Assistant Secretary MacCracken, Director Young, and on down through the Regulations Division to type engineer and inspector, the order has been the same.

"If you find something wrong with a plane, tell the manufacturer what it is, and lay quiet about it. Help him as much as you can without stepping on the toes of the private consulting engineers. Keep quiet."

An example of this, here is a situation that occurred. A certain airplane was found to be dangerously dangerous. It was weak, unstable, and on a short time would have been probably delayed as a means of permitted to get into the hands of pilots who did not realize this condition. It was sitting in large numbers. The Department was worried, but the manufacturer did not appreciate the weakness of his plane and he did not show much desire to co-operate. Yet it did not want to put him out of business. Time was precious, the Engineering Section put one of its experts on the job, had every defect located and a proper remedy suggested. The manufacturer, at first somewhat suspiciously realized that he had a dangerous escape from disaster.

There was an exceptional case. The Department cannot relicense airplanes, even if it had enough men to do the work. That is the reason for the so-called "one-time" rule that was to the responsibility those who rules occasionally had to be suspended for the good of the industry. The result is that someone justified the excuse. That place is no longer a menace. It enjoys popularity and a good name among those who fly it. It is making money for its builder. Yet one simple "Subpar" by a Department of aeronautics might easily have put that company out of the market. For the airplane is not live in a moment. Thousands of people think the "Subpar" air but they are not afraid to ride in it. That riding in the world would get into into a plane with a reputation for collapse, even permanent spinning, gyroflexion, and other unpleasant symptoms of that sort.

This is only one of many cases that could be given to show that the Engineering Section is trying to help rather than hinder the industry. It has never turned down a request for an approved type certificate without a full explanation, and as indication of the facts. When the faults have been corrected the Section takes the request as a new one, forgetting the former errors, even though they may have plainly shown an attempt to "get by."

Other elements enter into the matter of getting planes approved. Some engineers in the industry forget to comply with the standard procedure in submitting drawings and data. Not infrequently the information sent is so in such a haphazard condition that the Department has to ask for detailed explanations—or even have the engineers

come in and point out what they want. This increases the time for handling the case by several hundred per cent.

Even when the information and drawings are in standard shape, it takes considerable time to check the important components and inspect the drawings to see that good engineering practice and Department requirements have been followed. There is always a stack of blueprints waiting action in the Engineering Section—while the handful of engineers work through others ahead of them on the list. Almost the full time of one man of the six is taken in answering important queries as to the delay in certificates, or other matters. And there are inevitable interruptions from visitors, visitors, and avoid-avoid-avoid-avoid-avoid.

The full time of not more than four engineers is available for relicense of old type airplanes and issuing a data. The rule in the Section is, "Do all you can to complete cases quickly—but don't slip through. Don't take anything for granted."

There is one of our big trouble would be extremely serious. The spirit of criticism, the industry relies on the members of the Engineering Section for safety. Perhaps some builders have codes of their own that are even higher—but they are actually interested in knowing that other planes operating on airports and in airports come to them on planes that have built a reputation for safety and good public confidence. The airplane buyer and the air traveler have been educated to look for the A.T.C. insignia, and the known number. The first best-off case—that a great defect in an approved type plane is found to have caused a big crash, the belief in Department of Commerce standards will suffer a great decrease. And what other standards are known at the present time?

The effort to make it responsible not only in the United States, but in regard to foreign markets, for the lack of foreign sales is the guarantee of airworthiness by the Department.

The Engineering Section cannot afford to make any such mistake. So it means careful—and care doesn't go hand in hand with haste. The only solution is more engineers. But try to get them!

The first basic complaint that the Department's engineers are far too theoretical, that sometimes authoritatively they are right but practically wrong. This would resolve itself into a battle between engineers before it could be settled, but this matter has an answer in reality. From time to time the Department has looked at other planes which the Engineering Section believed "questionable." I had said these covered both types satisfactory.

Shortly afterward I had an opportunity to fly in one of these planes. It looked sturdy, reliable and it was an airplane plane. But I realized a little later that when plane went into a beautiful spin and remained there until it was interrupted by sudden contact with the ground. Others of this same make have gone through similar dubious performance—stalling in flight. Despite all the preference of the Engineering Section is sufficient for me. A plane is a myth—theory or no theory!

—This is the second of a series of articles prepared by Mr. Arthur C. Brown, with the assistance of Philip J. Brown, in the preference of the Engineering Section. The third will appear in an early issue.—Ed.

PLANES THAT Fly OR

IT IS a common failing to over-emphasize the importance of one's particular line of business activity in relation to the general business world—and likewise, an individual's interest in a given business in relation to the business itself. Yet, if I were asked to name that branch of the aviation industry which is most important and far-reaching in its effects on the economic success of actual transportation, I should say, and I believe without exaggeration, that it is the manufacturing, and its accompanying problems of engineering and commercial research.

If commercial aviation is to achieve real progress it must be profitable. In making aviation profitable the manufacturer plays probably the most important role of all. Why? The whole answer lies in this fact—there is a vast difference between the building of planes which will fly and the building of planes which will show an attractive operating income to commercial carriers. Let us examine briefly the manufacturer's position.

Seldom a day passes without the announcement of the formation of a new airline. Mergers and syndicates representing airlines and hundreds of millions of dollars are being quickly into existence. Individual carriers and finance houses are striving upon every opportunity to join the hordes of merchants of the new "golden flier"—to become part owners of the money-laden agencies of the air. It is a veritable hey-day of the skies.



Aerial view of the plant of Metal Aircraft Corporation, Cincinnati, O., manufacturer of the "Shinnings". A portion of Eastern Airport is in the area in the background.

The all-metal "Shinnings"



However, the very novelty of the industry, itself suggests its speculative nature. As in other lines of investment which are now intensely interesting and speculative, stockholders will be content to pass the first several dividend periods without a definitely noticeable showing of strength. They will agree to expenditures which are profitable not as conservative as they should be. They will listen to recommendations which later will prove to be unsound. All this they will do for a time as a tribute to romance, and for lack of established precedent in the industry itself.

BETWEEN now and then there will be a day of reckoning—a day when dollars and dividends will be the only surviving answer at stockholders' and directors' meetings. It is on this day that the manufacturer must study statistics, and if he conscientiously expands his activities beyond those of simply manufacturing—of simply assembling wings, fuselages and engines—this day may be averted. I said before that there is a vast difference between planes which will fly and planes which will earn in transport duty. A plane may be perfect from purely an engineering standpoint, yet highly impractical from an operating viewpoint. It is the correlation of the engineer's design with the public's requirements of actual operation which determines the successful plane. In order to reduce this correlation it is necessary to tell into action practically the entire production and selling organizations, together with the design staff and a special department for commercial transport research. The selling organizations bring in the public's present problems. The department for commercial transport research analyzes the public's future problems. The production department modifies design so as to prevent occurrence in methods of fabrication. The design staff enters into the public's requirements of the present and future, along with produc-

PLANES THAT Earn?

A Manufacturer of All-Metal Planes Expresses Opinions Regarding Airplane Construction

By THOMAS E. HALPIN

Pier President and General Manager
Metal Aircraft Corporation of Cincinnati



Thomas
Halpin

tion modifications into a design which will operate efficiently today, and which tomorrow will not suffer from obsolescence. It will be of interest to see how this plan functions in the manufacture of our "Shinnings".

Take for example our selection of structural materials. Purely temporary construction would probably dictate the use of wood and fabric as offering wider profit margins for the manufacturer. Wood is cheaper to stock and costs the manufacturer's investment which is tied up until production is sold. But when wood is suggested as a structural material there is a stamp of criticism and protest from all five of our departments: the Design Staff, the production department, the selling organization, the Department for Commercial Transport Research and now all five of our customers.

The Design Staff points out that the loading, fatigue and joining strength of wood cannot be gauged with the accuracy and certainty that is possible with metal.

The production department cites that metal can be given almost any form in fabrication, while the working of wood suffers distinct limitations.

The selling organization emphasizes that wood and iron structure affect its selling advantages.

The Department for Commercial Transport Research emphasizes the necessity and short life of wood, and stresses the fact that the trend in all engineering structures is very definitely toward metal.

The public—who after all deserves the greatest consideration because its investment is at stake—speaks primarily in terms of its investment. It urges metal structure because of the very low rate of depreciation, the low maintenance, the ease of inspection and serviceability—but above all because metal assures revenue permanence with its increase of the fire-burned and its generally increased safety factor.

OF SIGNAL IMPORTANCE and vital concern to the public investment in airlines is the question of the capacity and speed of transport planes. As the industry grows, as competition intensifies, there will be radical, over-night changes in the sources of revenue producing traffic. Airlines which will have equipped themselves with one type and capacity of plane in anticipation of a steady flow of a given class of traffic will suddenly find themselves bereft of that class of traffic for reasons of competition

or for other unforeseen changes. Such disappointing changes and sudden changes in demand conditions are a characteristic of every business enterprise, and the most subtle and well-organized transportation media.

It is obvious, then, that the manufacturer must design, not so far as possible, utility equipment which can be readily switched from one class of service to an entirely different class when economic demands, without loss of time or excessive cost to the transport operator. We feel that we have achieved this end in the capacity and speed of the Shinnings, which has been built to accommodate both mail and passengers, a plane which can be operated efficiently in express service occasionally, a plane which is not too large to press into service as a night-mailer until during odd hours at terminals, a plane with more than the necessary speed and economy in total air time, and a plane possessing the extreme power and reserve engine margins for the slightest demand of profit-paying loads over all kinds of terrain.

DEMANDING PLANE that will not become obsolete in the course of a few years is the problem assigned to our department for commercial transport research. Its task is that of pulling back the veil of the future—studying and plotting graphically the sources and flows of future air traffic—forecasting conditions of weather and terrain along new airlines—considering the speed requirements of the future—contemplating with existing methods of transportation—analyzing the volume and varying rate of traffic flow—all so that planes may be built now, today, which will function profitably tomorrow.

When one regards the unprecedented growth of the entire industry of transportation, its economic problems and perplexities, its tremendous outflowing with public investment, which must be safeguarded and which must soon show definite earnings, one realizes more keenly the grave trust that is vested in the manufacturers of aircraft. There is the privilege to shape the successful destiny of aerial travel. And, in conclusion, if I may be permitted to repeat, their greatest problem is to build transport planes that will earn—not simply planes that will fly.

THE LeBlond Sixty (MODEL 5-D)



THE LeBlond Sixty Engine, Model 5-D, which is now being manufactured under Approved Type Certificate No. 12 by the LeBlond Aircraft Engine Corp., Cincinnati, O., is a five-cylinder, single radial, air-cooled type having a manufacturers rating of 60 hp at 1,800 r.p.m. and an approved rating of 55 hp at 1,500 r.p.m. Approval followed a fifty-hour endurance test conducted by the Navy Department at the Aero Engine Laboratory, Naval Aircraft Factory, Philadelphia Navy Yard.

The LeBlond Model 5-D has a bore of 4.125 in., a stroke of 3.750 in., giving a total piston displacement of 240.56 cu. in. The compression volume ratio is 7.4:1 to 1. The overall diameter is 4.91 in., overall length 22.1 in. and dry weight 300 lbs. Nearly 90 per cent of the parts are interchangeable with other LeBlond models.

Cylinders are cast from nickel iron in single units with cooling duct integral. Each cylinder is held to the crankcase by eight studs which pass through the half-dowels flange. The outer end of the cylinder barrel extends into the crankcase a distance sufficient to prevent cooling of the lower cylinders.

The outer surface is finished with a glassy, black zinc enamel capable of resisting heat. The inside and also the outer portion of the cylinder barrel below the flange is finished all over. The bore is held to close tolerances and given a good finish by honing. The combustion chamber is spherical in shape and provides seats for the interchangeable inlet and exhaust valves which are located at an angle of 30 deg. to the cylinder axis.

Valves are stainless steel with 45 deg. seats. Removable valve guides are pressed into the cylinder. The interchangeable valve springs are of the valve-operated type holding about 60 lb. at valve-open position. Each valve is held by a split retainer setting with a spring in the valve spring collar, and a wire safety clip circles

the valve stem below the collar to prevent the valve from dropping into the cylinder. The cold intake clearance is .0015 in. and the hot intake clearance .0035 in.

Two spark plugs are provided at diametrically opposite positions front and rear. The inlet and exhaust valve ports face the rear, thus making the arrangement simple for the attachment of an exhaust collector ring.

Thrusting sleeves are secured into each port and protrude sufficiently to receive an anti-rattle parking nut. The valve pin seat and its chamfered relief receiving a cylinder. Valve guides are pressed on in the squared ends of the rocker shafts which are supported in bronze bushings pressed into the cylinder. Lubrication of these bushings, as well as the enclosed valve ports, is accomplished through a fitting from the outside.

The piston is aluminum alloy cast in permanent moulds, and heat treated to give the desired hardness. It has a full skirt and three rings above the piston pin, the lower ring functioning as an oil scraper. The head of the piston is of ample thickness for cooling and is also equipped with ribs underneath. The piston pin is hollow, the outer surface being sandcast and lapped to close dimensions. In each end is pressed a diamond pin to prevent the piston pin from scoring the cylinder wall.

Articulated-type connecting rods of an extremely simple design are employed. The rods are made from nickel chromium steel drop-forged, being finished where necessary so for the special purpose of removing excess weight. By leaving the skip of the forging on the "H" section of the crank, considerable advantage in strength results.

The master connecting rod and cap have a full bearing upon the crank-pin. The ball joint is applied directly to the shaft and the two are locked in one. The cap is closely fitted to the master rod with a stepped pin and they are held together and clamped by four axial and bolts. These bolts also loosely lock the wrist pin in

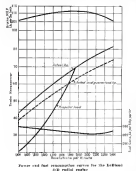
AVIATION
May 11, 1959

place, thus clamping numerous small pins that are in frequent use. The bolts have thin square heads which run against shoulders to prevent turning and thus are made tight by long hexagon pins locked by cotters. The master rod length (center to center) is 7.75 in.

Link rods are interchangeable, and would otherwise be reversible if it were not for the necessity of placing the end which has the oil hole to the outside to permit splash lubrication of the bearing. The bearing bushings which are pressed into each end of the link rod and run the upper end of the master rod are able. Link rods are \$3.85 in. from center to center.

Wrist pins are hollow and the ends are closed by Welch plugs that are permanently secured by packing. The half-round slots in the wrist pin fit fairly close around the bolts, the widest slots in the bolt being used in conjunction with drilled holes which line up with holes in the master rod and cap to supply oil under pressure to the interior of the hollow wrist pin. Lubrication of the wrist pin is in a hole which leads oil to the link rod bearing. All wrist pins are interchangeable. The outer surface is case hardened, and exact dimensions together with a near-perfect finish are obtained by lapping.

The single-throw crankshaft is drop-forged in one piece from nickel chromium steel (S-A E 345). It is finish ground all over and counterbalanced by brass weights which shoulder against two lugs on opposite sides of each crank cheek. These weights are located in



Power and heat rate characteristics for the LeBlond Model 5-D engine.

screws which are permanently locked. The overall length of the crankshaft is 12.5625 in. and the journal diameter is 1.0064 in.

The crankshaft is supported upon two ball bearings—the one for the front being assembled later as it is included within the crankcase cover to carry the propeller

flange. The inner race of each bearing is locked on the shaft by a nut, and shoulders against a ring against which provides sufficient room for wear. Oil seals between the crankshaft journal and cheek. The bearings are lubricated by splash.

For mounting the propeller hub the crankshaft is provided with a tapered end to which there is a key slot and two tapered holes for the screws which retain the key. The shaft is hollow in entire length the hole in the rear journal being made larger, and it is closed at the rear end by a Welch plug. The rear drive shaft, which forms a part of the gear case assembly, slides into the end of the rear journal and is driven by the lugs which fit into the slot at the end of the crankshaft. These lugs are all center so it is impossible to assemble either crankshaft or gear case, except in the correct position, over the valve timing is adjusted. 450 enters the crankshaft under pressure through the hollow cam drive shaft. It then flows to the hollow crankcase by means of a hole drilled through the rear crank cheek.

THE CRANKCASE, which has a diameter of 1.75 in., is provided with three holes for feeding oil to the oil-receiving rod bearing. The two smaller holes near the ends of the crankcase are so located as to match most results with holes in the rod bearing that lead to the link rod wrist pin. All the oil kept left to the bearings must first pass through a special cast aluminum oil plug which is regarded as one of the interesting features of the design. This plug is so arranged that any heavy particles of dirt or oil, which are naturally drawn in the outside by centrifugal force, become permanently trapped and are thereby prevented from passing through the bearing. Undoubtedly, this is a contributing factor to the long life of the outstanding rod bearing. The oil plug is held in position by a cotter pin and it can be quickly removed at any time for cleaning.

As previously mentioned, the propeller hub is driven through a key on the tapered end of the crankshaft. A special nut with holes for a locking wire drives the hub up tightly on the taper. At the outer end of the hub is a pin which is secured with a lock washer. The pin on the propeller hub nut locks when removing the hub from the crankshaft. These two nuts are provided with means for locking against turning when the hub is in place. The propeller hub flange jacks on the front of the hub and the propeller shaft on both ends and is secured and held between the two by six sets of bolts and nuts. The hub has a body diameter of 2.000 in. and a bolt circle diameter of 4.625 in. The distance between flanges is 4.0625 in.

The crankcase is a heat-treated aluminum casting of high tensile strength. It has a large opening in front through which the crankshaft and connecting rods may be inserted in its assembly. This opening also serves as a port for the largest chromium carbide cover which is heat treated to obtain high tensile strength. It is held in place by three studs and one which connects with the studs at the rear is the provision for attaching the gear case assembly and the hollow down through which the oil passes to the scavenger pump serves as a locator.

The integral oil manifold is a separately cast piece in the form of a ring with openings to receive the inlet pipes and one which connects with the crankcase through the crankcase of pump. Hence, there are few joints which might possibly develop leaks and the oil is cooled by the incoming pump.

The wall central with this inert crankshaft ring provides a support for the main crankshaft bearing. The ball bearing is supported directly on a steel sleeve which is pressed into the crankcase and held in place by three counterbore head screws permanently locked from turning.

Cast-iron linkages with holes ground to close form are pressed into the crankcase to serve as guides for the cam followers. These cam followers are in the same transverse plane, this being made possible by the use of the single cam ring which will be described later.

The cam followers are made from an alloy steel heat-treated to give both hardness and strength. The followers are driven by the cam and revolve in the crankcase a push rod ball socket which is pressed into place. A special lock screw serves to keep the follower from turning about its axis and prevents any possibility of its dropping out when the push rods are not in place. At the rear end of the cam follower is a slot to guide the hardened roller and a half-round bearing for its two small journals. The safety wire is merely to insure that the roller will not drop out of place when it is not in contact with the cam as it is assembly.

On the inner lower side of the crankcase, the finished part with its shaft provides a means of attaching the oil pump. Excess oil drains into this sump from the crankcase both from side and from front the oil is drawn through the hollow dowel, leaving the oil sump, as it is being returned to the scavenging pump. All seals are made from alloy steel, and the threads are held to close tolerances to insure good fit.

The front crankshaft ball bearing is supported by the crank case cover in a steel sleeve that is held in place by three counterbore head screws permanently locked from turning. This bearing is held in place on the outer ball race to locate the crankshaft and to carry the thrust load of the propeller. Between the bearing and the crankshaft rail is an oil thrower which, together with threads in the flange of the crankcase cover, prevents oil seepage to the outside. The nut on the crankshaft bearing is secured by turning the inner race of the ball bearing in locked form, turning by the propeller lock key since it extends into one of the bearing slots on the nut.

On the front of the crankcase cover is a main plate and four studs which are to be used for attaching a support for the forward end of the cooling fan.

The gear case is assembled in a unit before it is incorporated into the final assembly of the engine. The gear itself is an aluminum casting, having a round flange and pilot where it attaches to the crankcase. In the central well are two bosses, each receiving bronze shoulder bushings pressed in from the ends. On top is a pad for supporting the magnetic drive shaft bearing, and in line with it at each side is a bracket for supporting a mag sets. Below is a flange for attaching the oil pump. The cylindrical opening in the case serves as the outer housing for the oil pump when the latter is in place. Sufficient space is provided for assembly and adjustments by the opening at the rear.

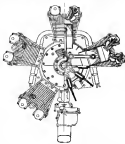
The central boss supports the cam drive shaft. Oil enters the interior of this shaft through a hole which is in line with the space between the ends of the bushings and it passes directly through into the end of the crankshaft. This has already been explained that the end of the cam drive shaft goes into the end of the crankshaft and the two off-set lugs engage with the slot as a means of

drive. The cam is provided with a bronze bushing sleeve it fits on the cam drive shaft. Oil is fed directly to the bushing through holes in the wall of the cam drive shaft. The cam ring operates all valves and when the gear case is in place these cam are in line with the cam follower rollers.

At the rear end of the cam drive shaft is a spiral gear driven through a key. The nut which holds the gear up against a shoulder on the shaft is held from turning by a taper pin secured by a cotter. This nut is furnished with a female splined end to connect a starter.

This spiral gear drives at half engine speed another spiral gear which meshes on the hub of the cam timing flange. The latter is keyed to the idler shaft and driven by four special screws which set the valve timing through the adjustment of a differential series of holes in the two pieces. When the timing is set, the hub of this flange is clamped against a hardened rubber which rests against a shoulder on the idler shaft and also takes the gear thrust on the flange of the bronze bushing in the gear case. The clamping is done by a special nut provided with a dove for a tachometer cable. At the opposite end of the idler shaft is a gear meshing with the gear which is an integral part of the cam. The idler shaft bushings are lubricated by a pressure line in communication with the main oil pump. The idler shaft bushings are supplied.

Above and at right angles to the cam drive shaft lies the magnetic drive shaft. Central on this shaft is a gear driven by the spiral gear which is located at the rear end of the cam drive shaft. Shoulder bushings are slipped



Front view drawing of the Lockheed A-1 engine with section cut away to show interior mechanism.

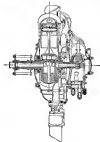
upon the magnetic drive shaft from each end. They are located between the two halves of the bearing and prevented from turning by dowels. These bushings are fed with oil under pressure, and at each end of the shaft is an oil thrower as well as threads in the housing to return the excess oil to the gear case.

The cast aluminum cover which closes the opening at the rear of the gear case is bolted by two dowels and

held in place by eight screws. In addition to the three long studs in the gear case, three other studs are fixed in the cover to permit the mounting of an electric starter or the cover which closes the opening central with the crank axis.

In line with the idler shaft axis a special stud is screwed and locked in the gear case cover to provide a means of attaching a standard tachometer connection. The flange which is cast integral with the cover, has lugs to retain oil spray and a conical screen at the outside opening to keep out dirt.

The oil pump is built up of three cast units, a lower body, an upper body and a plate. These parts are all aluminum castings. In the upper body are the pressure gears, the driver being integral with the oil pump shaft at whose upper end is mounted a special gear which meshes with the large half-cam-speed gear. The plate

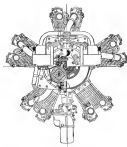


A transverse section of the Lockheed A-1 engine.

pressure gear is located and it turns about a bolt which is used to tie the pump together. Oil enters the pressure pump through an opening in the plate and lower pump body. As it leaves the pressure pump, the oil must pass through a cylindrical screen of fine cloth which is held between the upper body and plate. Once through the screen, the oil can enter the divided openings in the gear case which lead to the bearings or in to the pressure relief valve.

Below the plate is the lower bearing are the wider gears for scavenging. The driver is steel and it fits over a square on the drive shaft. The driver gear is bronze and it centers on the same key bolt as the pressure driver gear above. Oil enters the cylindrical opening in the gear case surrounding the pump through the hollow dowel which is used to locate the gear case. It must pass through a coarse mesh screen before entering the gears.

The pressure and scavenging oil connections for the driver to the outside oil tank are alike. A bronze stud locates the bronze connection up against the lower body,



An rear view section drawing of the Lockheed A-1 engine.

a copper extension gasket having used above and below. These connections may be turned in any convenient position for the oil lines.

Excess oil from the pressure pump goes through a relief valve and re-enters the inlet side of the pump. The desired oil pressure may be obtained by screwing in or out the adjuster located at the lower rear of the lower pump body. The adjuster gives the relief valve, the latter being below the pump, a guide for the coil spring. The two oil connections, studs, the adjuster, as well as the two long screws which help hold the three sections of the pump in a single unit are all secured by lock wires.

A Standard NACA-RB carburetor having a cross jet needle control, is provided and an air heater can be furnished as special equipment. Dual Bendish magnetos (Model PN-50) are furnished and rotate in at 11 crankshaft speed. Spark timing is fixed at 25 deg advance. The standard timing (hot) is inlet opens 0 deg, inlet closed 60 deg late, exhaust opens 60 deg late and exhaust closed 0 deg.

The specifications as furnished by the manufacturer are as follows:

Model	S-1
Manufacturer's rating	60 hp at 1500 r.p.m.
Approved rating	65 hp at 1550 r.p.m.
Number of cylinders	Two
Cylinder arrangement	radial
Cooling	air
Weight	4,125 lb.
Stroke	3.750 in.
Displacement (total)	250.98 cu in.
Compression ratio	5.42 to 1.
Overall diameter	12.1 in.
Overall length	25.1 in.
Dry weight (complete)	222 lb.
Weight of mounting ring	5 lb.
Weight of exhaust collector (approximately)	68 lb.
Weight of carburetor air heater	29 lb.

SYSTEM AND ORDER IN THE Stock Room

By WILLIS PARKER

THE stock room of the Alexander Aircraft Company, Colorado Springs, Colo., is well arranged and is conducted to facilitate the filling of requisitions and the distributing of materials in the various departments of the plant. It is also conducted so that it serves as a check against the control board in the factory office, and it is in turn checked by the control board against having too much of any type of stock.

Let it be stated at the beginning that the stock room has its own delivery department and that no department foreman, or any of his employees, need to call at the stock room for materials in the regular run of production. The stock room delivers the materials to the departments on orders of the production superintendent or his assistants. In some instances the department foreman does not know until he receives the material, that his department is expected to turn out certain work. Incidentally, we might mention that no one is permitted in the stock room except the members of the stock room staff and a few officials of the company.

We shall start the explanation of how this department is conducted by taking a hypothetical instance of an order for a job to be done. In the factory office is a book in which is listed the various sizes and quantities of items required for the construction of the various parts and sub-assemblies used in the construction of an airplane. A common example is a 15-hp. power plant. The construction of this unit requires 53 parts. The list of parts representing such a job is a "B2E" list.

The stock room foreman has a similar book. In one run of such work he is instructed, the requisition, as made out in the factory office along with the factory work order, specifies "Ten—B2E lists." When the stock room foreman receives the requisition, he looks up his B2E list and instructs his men to multiply it by ten and get out the various items listed on it.

When the requisition is filled, the materials are transported by stock room employees to the department where the work begins. The department foreman inspects the materials, counts it, and then reprints the requisition. In the meantime, the factory order is on its way. Sometimes the materials arrive in the department before the factory order does, which explains why it is sometimes likely that the first reference the department foreman has of his next job is the receipt of materials for it.

The bins in the stock room are located in such a manner that the materials stocks in them are placed nearest to the department in which they are to be first used. For example, the taking in of the north end of the stock room for the welding department is in the north section of the building.

Every on several pairs of experimental rollers where no lots of materials has previously been compiled at

is never necessary for the employees of any fabrication department to go to the stock room. Direct on experimental work, the materials are delivered only on requisition and the requisitions must be signed by some one in the factory office. The factory's messenger service is sufficient to eliminate the necessity of a department foreman visiting the stock room for materials, and such he can make out his requisition. Place it in a basket on his desk and it will be picked up by the messenger and delivered to the factory office clerk, who in turn, passes it along to the stock room for action. The stock room delivery system then picks up the material and transports it to the department.

IT TAKES ON something of the imagination to understand how much time in the construction department this system saves for without a doubt, if an employee was sent to the stock room to get some item he would find around the stock room waiting for the stock room clerk to get the material and deliver it to him at the machine.

Even on loss of materials, occasioned by change in fabrication, it is not necessary for the department manager to go to the stock room for material to replace that which has been damaged. He makes out his loss and change report, lists the material he will require and it follows the procedure of being picked up by the messenger and placed in the proper channels for action.

Size and materials delivered by the stock room have, too much of these are prepared in the stock room. An example is tubing. The lengths and angles are specified on the order. The stock room cuts the tubing to the right length and at the proper angle if it is a straight angle, whatever the welding department needs, why it will go to the corner required. Next to the racks on which the tubing is stacked, are bins in which short lengths are kept. From this bin the stock room fills orders for short lengths. A tremendous saving in taking results from this system.

The pick-up boys use boxes mounted on wheeled trucks for gathering up materials from the various bins. These are wheeled to the conveyor system where they

are placed on a system, which is eighteen feet long and about ten wide, and is supported by rods from the wheels that run along the overhead trolley. The overhead trolley system extends throughout the entire factory and outside to the front slope and haul-down assemblies, so the "chase" is only made, the error to the proper department and return the material to where the department receives it.

The control board in the factory office also acts as a perpetual inventory system. When the requisition has been filled and receipted for by the department foreman, it is turned back by the stock room foreman to the factory office where the amounts of such items are checked off the control board. As a double check on the control board there is a little card in each stock bin with squares numbered for the sub-items, and the dates the sub-items were made. When the sub-items have been made, the card is returned and a fresh one issued in its place. The card is sent into the factory office for comparison with the figures shown on the control board. If there is any discrepancy, it is immediately investigated.

Five sub-items, as a rule, will be made in a short period of time and not so long a time that any losses in the system will prove a loss.

Scarcely all materials, parts and sub-assemblies remain under the control of the stock room until they are installed in completed planes, there are many rooming areas—rooms fabricated in the factory from materials previously damaged by the stock room. These items, as inspected as they come in, the number received indicated on the sub-item card and added to the total on hand. The factory office is then informed and the amounts received are submitted on the control board. The control board, in turn, gives out ten such a card, one being on hand in the stock room at a time.

Large sub-assemblies, which off under the production of the stock room are, not always moved into the stock room when completed, but are stacked in the assembly department, the stock room ordered with them and they are withdrawn only on order of the stock room. This system saves on handling the materials too much, according to C. C. Hornaday, factory superintendent.

The receiving room and shipping room are given space in the stock room. All materials are inspected as they come in, whether from the suppliers of new materials or from the factory department, are inspected as they go out and are again inspected by the department foreman who receives them. This eliminates such delay and the saving of additional manpower to take care of a freight material after it has been received in the department.

The new Alexander Engineer Model 15 "Baker" powered with a 15-hp. motor engine



1 Three propeller, open cockpit, Engineer Model, powered with a Wright 25 engine

Mono Craft Rights To British Concern

Fokker Purchases 1000 Thorpeneut Oil Heaters

ST. LOUIS (AP)—Allied American Industries Inc. has entered an arrangement with an English company for the sale of 1,000 mono craft and Thorpeneut oil heaters. The heaters, which the company's products will be distributed in the United Kingdom and all British possessions, except Canada. Submarine sales are expected to stimulate the market in Australia and the Dutch of South Africa through the acquisition of the English company. The heaters, which have been approved in South Australia and the Philippine Islands, and are intended to supply the fuel for the propulsion of distributors in Canada and the principal countries of Central and South America. It is said.

The Fokker Aircraft Corporation has just placed an order with the Thorpeneut Oil Heaters Corporation, a subsidiary of Allied American Industries, for 1,000 Thorpeneut oil heaters for use in Fokker planes. The heater is used for heating the fuel supply in aircraft, and is designed to burn kerosene and other fuels in a simple and efficient manner.

Landlord engines are the most popular type used by the Fokker V-15, which have been taken over by the Landlord Aircraft Engine Corporation, a subsidiary of Allied American. The Mono-Air Corporation, a third subsidiary, acquired the assets of Mono Aircraft Co., also of St. Louis, and is continuing the manufacture of the best known of the Thorpeneut, Mono-Air and Mono-Air.

Plans and engines will be taken over by the Thorpeneut Oil Heaters Corporation, which is now being reorganized in England in order to avoid tariff charges.

Finns Change Names

ALBANY (AP)—The Finnish Air Force School, incorporated in Albany, N. Y., has had a certificate in the office of the secretary of state change its name to the Finnish Air Force School. Incorporated and changed its capital stock from \$100,000 to \$200,000. The school is now located at the Connecticut Air Force School, New York City, and has a certificate in the office of the secretary of state to incorporate under its present name.

Wingspan Exports 50 Planes

WINNIPEG (AP)—More than 50 aircraft, including 10 biplanes, which will come from the United States, are expected to be shipped to the United States and to be sold here. The aircraft are being shipped under the auspices of the Winnipeg Flying Club. Among the planes expected is a Ford Triplane from Detroit.

Island Going Into Production

KANSAS CITY (AP)—Island Aviation Company, Inc., has just begun the construction of the Island Sport, a new type of aircraft, in its new plant at Kansas City. The company is now in the process of building a new plant at Kansas City, and is expected to begin production of the Island Sport in the near future.

Feen Jensen Company To Manufacture Planes

NEW YORK (AP)—A new company, the Feen Jensen Company, has been organized in Albany, with a capital of \$100,000. The company is expected to manufacture planes, and is expected to begin production of the Island Sport in the near future.

It is stated that a large part of general has been accepted in Newark, where a trial will be held. Here it is planned to manufacture planes and also to develop and export certain patents, among them the new propeller principle for use with airplanes.

Southern Order Places

NEW ORLEANS (AP)—A new passenger line, the Southern Air Transport, has been organized in New York City. The line is expected to begin operation in the near future, and is expected to provide service to the Southern States. The line is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Canter School School Opens

BOSTON (AP)—The Canterbury School of Aeronautics, which has been organized in Boston, is expected to begin operation in the near future. The school is expected to provide instruction in the field of aeronautics, and is expected to provide instruction in the field of aeronautics.

Wingspan Exports 50 Planes

WINNIPEG (AP)—More than 50 aircraft, including 10 biplanes, which will come from the United States, are expected to be shipped to the United States and to be sold here. The aircraft are being shipped under the auspices of the Winnipeg Flying Club. Among the planes expected is a Ford Triplane from Detroit.

Berliner-Joyce Firm Ceremonies Has Features

BALTIMORE (AP)—The Berliner-Joyce Firm, which has been organized in Baltimore, is expected to begin operation in the near future. The firm is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

It is stated that a large part of general has been accepted in Newark, where a trial will be held. Here it is planned to manufacture planes and also to develop and export certain patents, among them the new propeller principle for use with airplanes.

Sporn Open Takes School

TULSA (AP)—The Sporn Open, which has been organized in Tulsa, is expected to begin operation in the near future. The school is expected to provide instruction in the field of aeronautics, and is expected to provide instruction in the field of aeronautics.

Conqueror Fulfills in Fast Trip

GARDEN CITY (AP)—The Conqueror, which has been organized in Garden City, is expected to begin operation in the near future. The aircraft is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Fokker Designs Small Plane

MOLINE (AP)—According to reports, a new small "biplane" plane has been designed here by Clayton Fokker. The small craft, which is said to have been built here, is expected to be sold here.

To Move Reorganized Temple Firm to Dallas

TEMPLE (AP)—The Temple firm, which has been organized in Temple, is expected to begin operation in the near future. The firm is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

It is stated that a large part of general has been accepted in Newark, where a trial will be held. Here it is planned to manufacture planes and also to develop and export certain patents, among them the new propeller principle for use with airplanes.

Directors and officers of the company are: Charles M. Campbell, president; J. E. W. Thomas, vice-president; George W. Whitman, treasurer; Charles J. Jones, secretary; William H. Jones, assistant secretary; and J. E. W. Thomas, assistant secretary.

N.S.P.A. Meets

DETROIT (AP)—A recent meeting of the National Standard Parts Association, which has been organized in Detroit, is expected to begin operation in the near future. The association is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Plane Encountered in Air Crash

NEWARK (AP)—Reports here state that a small plane, which was encountered in the air, was encountered in the air. The plane was encountered in the air, and was encountered in the air.

Texas Transport Orders Hobbs

ST. LOUIS (AP)—Texas Air Transport has ordered some Hobbs, which has been organized in St. Louis, is expected to begin operation in the near future. The aircraft is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Serole Fleet To Tour Country

NEW YORK (AP)—A fleet of Serole planes, which has been organized in New York, is expected to begin operation in the near future. The fleet is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Planning World Non-Stop Flight

NEW ORLEANS (AP)—An announcement of a proposed non-stop flight around the world has been made in New Orleans. The flight is expected to begin operation in the near future, and is expected to provide service to the Southern States.

It is stated that a large part of general has been accepted in Newark, where a trial will be held. Here it is planned to manufacture planes and also to develop and export certain patents, among them the new propeller principle for use with airplanes.

Laboratory Building For Stout Engineering

DETROIT (AP)—Stout Engineering Laboratories, which has been organized in Detroit, is expected to begin operation in the near future. The laboratories are expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Union Carbine Units Move

CHICAGO (AP)—On May 11, the Chicago district and central divisions of the Union Carbine Units, which has been organized in Chicago, is expected to begin operation in the near future. The units are expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Plan Candler Field School

ATLANTA (AP)—Plans for a new flying school to be established at Candler Field, which has been organized in Atlanta, is expected to begin operation in the near future. The school is expected to provide instruction in the field of aeronautics, and is expected to provide instruction in the field of aeronautics.

Breeze Firm Applies For Portland Field Site

PORTLAND (AP)—The Breeze firm, which has been organized in Portland, is expected to begin operation in the near future. The firm is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

It is stated that a large part of general has been accepted in Newark, where a trial will be held. Here it is planned to manufacture planes and also to develop and export certain patents, among them the new propeller principle for use with airplanes.

Directors and officers of the company are: Charles M. Campbell, president; J. E. W. Thomas, vice-president; George W. Whitman, treasurer; Charles J. Jones, secretary; William H. Jones, assistant secretary; and J. E. W. Thomas, assistant secretary.

It is stated that a large part of general has been accepted in Newark, where a trial will be held. Here it is planned to manufacture planes and also to develop and export certain patents, among them the new propeller principle for use with airplanes.

Union Carbine Units Move

CHICAGO (AP)—On May 11, the Chicago district and central divisions of the Union Carbine Units, which has been organized in Chicago, is expected to begin operation in the near future. The units are expected to provide service to the Southern States, and is expected to provide service to the Southern States.

Plan Candler Field School

ATLANTA (AP)—Plans for a new flying school to be established at Candler Field, which has been organized in Atlanta, is expected to begin operation in the near future. The school is expected to provide instruction in the field of aeronautics, and is expected to provide instruction in the field of aeronautics.

Southern Firm Offers Model

BIRMINGHAM (AP)—A model of the Southern Air Transport, which has been organized in Birmingham, is expected to begin operation in the near future. The model is expected to provide service to the Southern States, and is expected to provide service to the Southern States.

FOREIGN ACTIVITIES



National Flying Services Progresses

LONDON, (REUTERS)—Further developments in the scheme of National Flying Services Ltd. for the establishment of a national chain of airports and flying schools and two services have been disclosed here. Among the developments is Lady May flying school for her solo flight to and from South Africa.

The central airport and country club near London is to be established at Harewood, where an elaborate terminal building stands. The 22 provincial club airports and 180 intermediate landing grounds will be distributed within an average interval of about 100 sq. miles. Equipment will include 50 light planes, engine aircraft and engines, 50 flying instructors and pilots, 50 licensed mechanics and 50 stewards, with a reserve staff of inspectors and engineers.

There will be a central reserve depot and supply depot, a radio information system, technical advisory bureau, sales and insurance organizations and an international telephone circuit. One of the features is that a member of one club is an honorary member of every other club and planes will be available to members throughout the system. One of the drawbacks is that a member of one club is an honorary member of every other club and planes will be available to members throughout the system. One of the drawbacks is that a member of one club is an honorary member of every other club and planes will be available to members throughout the system.

International organizations have appointed agents for the continental passenger lines and will pay particular attention to taxi work to meet the demand and arrival of the flying. Transportation in the taxi will be about \$25 per mile. The value of the service of machines and personnel will be to eliminate delays due to through or accident or other operation difficulties.

Belgian Aviation Expands

ANTWERP (REUTERS)—On April 29 the local aviation as well as an air service between this city and Brussels were inaugurated. Air services between Antwerp and Berlin, London and Stockholm will be started next year. The corporation of Brussels and the Belgian Government has been permitted to permit the Belgian company a subsidiary of 150,000,000 Belgian francs, covering a period of eight years. The new air corporation between Belgium and Belgium cities will be operated by Belgian in collaboration with a French company.

German Lines Over-Developed?

LONDON (REUTERS)—The recent cut in the budget for German air transport is considered here to be due to an over expansion of the network. Flying schools, the establishment of which was not sufficient demand to justify the facilities. The English are in the meantime a justification of their more conservative policy of development.

Foreign News Briefs

Cape Town—Kodak and Co. joins insurance have postponed their proposed trans-Atlantic flight for at least a year.

Belgrade—As the foremost Bulgarian air base has been opened, Czechoslovakia of the Bulgarian Navy.

An anti service from Stuttgart and Oslo is being arranged for early resumption.

Further reports on English plans for a passenger and mail service to South Africa are reported to include a distance schedule which will occupy about 10 days. Great Britain paying more than half the salary, insurance and South Africa about \$600,000 yearly for six years. This trans-Atlantic service ship will be established in South Africa.

In spite of bad weather during February, K. L. M. reports a high degree of regularity in service.

Service arrangements have been made in Italy for air tourists without the usual formalities.

Windsor Aircraft Ltd., of Canada, had its extensive exhibit in the collection staged by the Montreal Light Aircraft Club last week.

Paris—A. Chen recently was awarded an air mail contract for the route from Paris to London and New York. His plans to use five four-engineered mail machines and mail operation very soon.

Captain Anthony, who is operating a one-stop flight from Stockholm to New York, recently found a single engine four-engine airplane of the "Brewer" type for the trip.

An association of commercial aviation engineers and manufacturers of aircraft and accessories is being organized in Montreal.

Western Australian Airways Ltd. expects to open its mail and passenger service between Perth, Sydney, to the West Coast of that continent in June.

Germany's proposed plan prohibiting aircraft bombing in wartime failed to receive the Preliminary Disarmament Commission.

Airlships to Fly Across Atlantic Soon

BREITLIN (REUTERS)—The two forthcoming trans-Atlantic flights of the German and English ships represent the climax of a period of intense rivalry in better-than-air progress. The German ship is scheduled to cross to America in or about May 12 while the English the giant R-60 commercial airliner is being prepared for a trip to New York and Canada the latter part of May or early in June. Its trip to the R-60 is expected to be made by the end of June.

During the recent Mediterranean cruise of the Graf Zeppelin the prospective chief of one of the projects was disrupted. This involved also removing and replacing the powerline while in flight. The terms of the dispatches show serious in recognition with the United States. Radio Berlin was successful. Its proposed trans-Atlantic world trip is now scheduled for July.

An transportation facilities between Germany and Scandinavian countries were in readiness, planned in March when the first trans-Atlantic transportation.

The second general meeting of the Council of Air Pilot and Air Management of the British Empire has been held in London. A technical Council was elected to supervise the organization.

Three de Havilland Mosquito have been sold to purchasers in Mexico through H. G. Fletcher, Kansas City agent.

Many light planes known as the P-17s are covered with the Salomon's engine under model air-crafted 50 hp. series are being built in France. The first British attempt to produce an open fly plane for private use.

It is reported that the R-60s, two-engine type, will be used for a proposed trans-Atlantic flight under the first month.

Exhibitors signed up so far for the Southern International Aero Exhibition at Olympia, England, in July, are 25 for the aircraft section, 16 for the engine section and 122 for the accessory and component section.

Three Douglas Mail flying boats for the Dutch Royal Mail will be sent to Batavia where they probably will arrive about the 20th of this month.

Three bonded passengers, about seven tons of mail and one ton of freight were carried by London-Gat. Air Transport Company, plane, this evening on the Luxembourg-Paris Island service.



Pyle-National Switches and Lights

LUMINOUS type toggle switches for airplane lighting systems is one of the recent developments of the Pyle-National Company, 1334-1388 North Kedzie Ave. Chicago. These special light handled toggle switches have a quick make and break mechanism in placed in a pressure vessel case. The entire mechanism is heavily insulated to prevent trouble from short circuits and grounds. The top of the switch handle is provided with a luminous insert which gives the location of the handle readily in the dark. Switches of this type can be furnished in two current capacities, the first of 10 amperes, 15 volt capacity, 2 made in one two and three pieces. The second is 25 amperes, 15 volt capacity, 2 made in two and four.

The 10 ampere switches are for use with type L-500 Pyle-National landing lights and navigation lights. The 25 ampere switch is for use with the type L-500.



The Pyle-National landing light (left) and fuselage field and tail (right).

Pyle-National landing lights. Switches are mounted on a sub-plate and are covered by the front mounting plate.

Another recent addition to the Pyle-National line is the recent "Anastigmat" (managing) light. These lights are designed to give maximum distance and angular visibility and are made in two types. The type for tail mounting has clear glass shells which the type for wing mounting is made right and left. Green glass shells for right wing and red glass shells for left wing are provided.

The arrangement of these lights is such that they will fit either chord or line wing or radiator section with equal ease at each light is made in two independent parts. This arrangement also permits the use of either one or two 3.6 or 15 CP lamp.

U. S. Rubber Products

INCLUDED in the aeronautical products of the United States Rubber Company is a complete selection of U. S. Rubber airplane tires and tail wheel tires as well as inner tubes. Sixteen tire sizes are offered in landing tires with wheel diameters. These are 16x3, 16x4 and 16x4.

Read each airplane tires are made in accordance with strip and ray specifications and are used by both branches of the service. To facilitate proper mounting on dry center support, there is a fine line guide which is

placed on the tire web wall which appears at the top of the tire flange when the tire is mounted on the wheel. The anti-skid tread on Royal cord tires for use on airplanes with brake equipment is the result of study to provide an effective anti-skid surface in the shallow depth recovery for airplane operation without increasing the weight of the tire and without creating a tendency to throw mud when operated on wet landing fields.

The tail wheel tires are built with the same care as the tires of larger size and they are no exception as to provide for rough landings.

United States Royal airplane tires are made from specially compounded light greenish high tensile cloth. Tires are cured in shape and designed to fit properly on dry center tires. These tires are made in accord with Army and Navy specifications.

Other aeronautical products of the company are rubber hose and tubing, grommets, shock absorber disks, shock absorber cords, gloves, air gloves, sealants and rubber mountings for airplane engines. Hard rubber products for airplane uses can be furnished in quantities.

Blaw-Knox Hangers

INCLUDED in the standard hangars manufactured by the Blaw-Knox Company, Pittsburgh, Pa., are five general types of hangars. These hangars are constructed from standard units and are available in sizes and designs to meet the various requirements. In all cases provision is made for maximum extension of existing equipment by the addition of new standard types. These hangars may be dismantled and re-erected in new locations without loss.

Walls and roof sheets of copper alloy galvanized steel are interlaced in such a way that no stress can be set in static conditions. These hangars are airtight and contractors and expansion cannot create cracks or holes to admit weather. Steel doors for these hangars can be provided to meet various requirements. Steel shaft of standard design with ventilating web and operating hardware are provided.

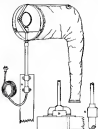
The type B hangar is made with standard heights under trusses of 8 to 20 ft. This hangar is available in eleven different widths ranging from 15 to 60 ft. The type W1 provides a clear span with spacing from 30 to 120 ft. This model is made in standard clear heights under trusses of 11 ft 7 in. to 23 ft 7 in. L-10s are provided with the type B hangar which is furnished in approximate widths of 80, 100, 110 and 120 ft. The 'low' to heights are 12, 16 and 20 ft.

The type BB is made in heights of 12, 16 and 20 ft for buildings 40, 50 and 60 ft wide. The approximate net widths are 30, 40, 50 and 60 ft. The type W3P is made in widths from 60 to 180 ft with standard clear heights under trusses of 11 ft 7 in. to 23 ft 7 in.

These hangars may also be used to store rooms and machine shops and it desired can have walls and floors of steel or terra or with rooms, heavier floors, offices, etc.

American Equipment Wind Cones

WIND cones of interesting design are now being offered by the American Equipment Company, 3838-60 Wadsworth Blvd., Chicago. These cones are available in both lighted and unlighted models, both types having the same general specifications. In the illuminated type a light is provided inside of the cone and varies with the cone, illuminating the entire figure. The cone is supported by an arm extending about one-third of its length and leaving the remaining two-thirds of the length free to sag in the wind. The wind velocity may be estimated by observing the angle of sag.



A drawing of the illuminated wind cone showing outline figure of cone.

in the free end. All metal parts are lacquered black to prevent rust from forming. A convex silver mirror held in a brass opening ring and secured in the light inside the cone.

These cones are made of U. S. Government specification slush, have a maximum diameter of 30 in. and a maximum diameter of 6 in. and are 7 ft. high. They are colorfully provided in white but may also be finished in orange color. Each of the illuminated types are provided with weatherproof Edison base sockets, 100 watt, 110 with inside frosted lenses, secured attachment ring and 24 ft. of heavy rubber cord. Three choices of mounting screws are provided. The cones may be mounted on a vertical post, horizontal post or a standard type mast. Replacement parts are ordered in stock by the company.

Tyco's Strut Thermometer

AN ACCURATE thermometer especially developed for high test work has been placed on the market by the Taylor Instrument Company, Rochester, N. Y. This instrument, which is known as the Strut Thermometer, is designed to be mounted on a strut where its large figure shows all of the measuring and not permit make it plainly readable from the cockpit. The size of the strut thermometer is 2 1/2 by 3 1/2 in.



SIDE SLIPS

By Robert R. Osborn

We were out to Roosevelt Field, formerly Curtiss Field, in Garden City, L. I., on May first, when the Curtiss Flying Service flew out of its old home port to the new Curtiss Field at Valley Stream. A sad sight it was too. The clouds hung low and dark and the field was wet with the frequent showers. The ships seemed to pull off the old ground reluctantly, trending quickly, with a long low turn above before heading off. The hangers which had gladdened the eyes of so many "greenhorns" of homecoming flyers seemed suddenly to become as old and gray and hopeless. There were some leaves and unshowered tears in the eyes of many who were flying away and many who were watching them go. Curtiss was leaving. The little boy, now grown to manhood, was leaving the old hangar to make his way in the world.

"London—With more than 12,000 letters, the first stream from India arrived punctually at the London airport this afternoon, and four correspondents who had breakfasted on India last Sunday morning were able to launch in London news and a half dozen late."—N. Y. Times news thus.

We do hope it was a good breakfast.

A news item since that Alon, the 172 pound young boy concerned with the side show of Ringling Brothers' circus, is planning to take an airplane ride.

This reminds us that we must renew our search for the professional painter that all of the airplane companies want use in obtaining their preliminary data. According to our calculations on some of the ships he must weigh about thirty-two pounds and have a perfectly streamlined head.

The *Twentieth Century* dropped in to say that he just before Henry Ford had announced retirement in the price of his airplane of \$2,000 to \$3,000, but that he was to be interested in any new ship and would offer him a good trade-in deal on his "Jenny."

While talking to the Bird Exposition over the radio recently, Mayor Walker of New York told them that when they returned next city would "take leave with his heart" and give them a great reception. Aside to Commander Byrd. The New York telephone directory is now so large it takes a good man to know how it is built. There has been tremendous activity on the Stock Exchange lately and there must be tons of ticker tape lying around the New York office. Better make your home-going entry in New Orleans or San Francisco.



Greater
Performance
Per Horsepower

—the keynote
of BIRD leadership

Performance data

with Curtiss COX-6

High Speed . . . 125 M. P. H.

Landing Speed . . . 35 M. P. H.

Cruising Speed . . . 180 M. P. H.

Gas Consumption at

500 M. P. H. . . . 5 gal. per hr.

Take Off Run . . . 100 Feet

Rate of Climb . . . 1,000 F. P. M.

Absolute Ceiling . . . 25,000 Feet

Endurance at

Cruising Speed . . . 9 Hours

NO FIELD TOO SMALL—

NO TREE TOO TALL.

ONE BIRD A DAY . . . a production schedule assuring dealers prompt delivery . . . adds to BIRD leadership in the popular priced class which sound design and practically tested performance have already established.

Dealer's franchise for this plane are still available in most territories.

Download of Curtiss COX-6 181



Safety and Performance

Brunner-Winkle Aircraft Corporation

7 Haverkamp St.

Goshok, Brooklyn, N. Y.

THANK YOU for supplying AVIATION

Danger that lurks in a FROZEN STICK is eliminated

By Design and Equipment the Whitley Avian is the finest plane in the world for training and sport.

In the records it holds the Avian has a real claim to fame—England to Australia, first solo flight—longest flight in a light plane—fastest time England to India—longest solo flight ever made.

But this famous light plane has made its real record in training and in club flying. It is regarded as the safest, most dependable and most air-worthy light plane in the world.

SPINS ARE OUT. Equipment includes one of the greatest achievements of modern aerodynamics—the Handley Page automatic slotted wing. The slotted wing accomplishes the following: Permits stalled wings without falling into a spin—enables ship to regain flying speed after stall with less loss of altitude than usual—materially improves lateral control by decreasing the constructing yawing moment—decreases landing speed—practically eliminates possibility of ship going into spins, stalls or fog.

SAFER LANDINGS. Split-side undercarriage with its unusually wide track, exceptional strength and greater resistance insure safer landings on rough ground. The Whitley Avian can be turned in its own length.



Designed for the sportsman pilot. The wings of the Whitley Avian can be folded by one person in a few moments. The telescopic pay wires, which must be placed in position before folding, are automatically slipped out of the upper wings when in use. With the wings folded, the Whitley Avian can be housed in a small shed.

For comfort in flight, for ease of maintenance and economy of operation, for maneuverability in the air and on the ground, no other light plane can approach the Whitley Avian in performance. It is the plane that will contribute to the flying instructor's reputation as a safe pilot.

SPECIFICATIONS

Power Plant—Curtis Model 18, 95 H.P. 120-hp, four-cylinder in-line aircraft engine. Proven for economy of operation and maintenance. Top overhead on 100 flying hours. Economy of 30 miles to gal. of gas—300 miles to gal. of oil—fuel. Maximum, 101 m.p.h.; cruising, 75 m.p.h.; landing, 35 m.p.h.

—Cabin, 15,000 feet—Cruising Range, 5 hours or 450 miles—Height, 12,000 feet—Maximum, 1450 lbs.—Top, 1600 lbs.—Dimensions: Wings span, 24 ft.; width folded, 46.5 ft.—Height overall, 6.6 ft.; length overall, 24 ft.—Price, Only \$4995, Plywood or F.O.B., Billingsport, Conn.

Jimmy Tully Made New a new record with national endurance. Both records are well open to anyone who desires and deserveth. For complete information concerning requirements, rules and details of this is your flying plane, write the Whitley Body Co., General Office and Plant, Billingsport, Conn. (United States Whitley Body Co.)



THE OUTSTANDING SPORT AND

TRAINING PLANE IN THE WORLD

Aviation has Awaited a Reliable Aeronautical Supply House

... and

**Robertson meets the increasing demands
for a fine, complete stock of all supplies**

The aeronautical industry, with its hurried needs and ever-increasing demands, has placed a premium upon prompt service and the ability to furnish every known supply or accessory—and the industry also has placed a premium upon the dependability and the genuineness of every product.

By stocking—completely—only AN specification and the standard, better known, commercial products, we can unqualifiedly guarantee every item we carry. By carrying a complete, full line of every supply, we can make prompt shipment and meet every aeronautical need.

—and by a large business volume, the largest in the industry, we can offer the lowest prices.

Guaranteed AN bolts, nuts, clevis pins, tubing, and other manufacturing supplies—fabric, dope, instruments—all Hiss and OX5 motor parts—all flying equipment—everything on hand.

And, by appointment, we are an authorized Wright Parts Dealer with parts for the popular Whirlwind motor ready for immediate delivery.

Our new parts and supply catalogue—completely representative, authoritative, and beautifully illustrated—is now in the hands of the printers, ready for mailing soon. And a catalogue envelope now covers every name and address for one of the advance copies. Mail in your request now.

Dept. W

Robertson Aircraft Corporation

All Aeronautical Supplies

Lambert-St. Louis Airport, Angham, Mo.
Division Universal Aviation Corporation



Britain's Air, Land and Sea Triumphs!

The Napier aero engine has
given Great Britain pre-eminence
in the air, on land and sea

SPEED IN AIR

The highest speed ever accomplished in the air was achieved by Flight-Lieut. D'Arcy Greig, D.F.C., A.F.C., in November last, when he covered three kilometers at the marvelous average speed of **319.5 m.p.h.** He flew a Supermarine seaplane with Napier engine. This same machine and engine, piloted by Flight-Lieut. S. N. Webster, A.F.C., won the Schneider Trophy at Venice in September, 1927, at an average speed over 200 miles of **281.669 m.p.h.**

SPEED ON LAND

The highest speed ever attained on land was made by Major H. O. D. Segrave when he drove his Irving-Napier car over one mile at the amazing speed of **231.36 m.p.h.** He used a Napier engine.

"Please accept my sincere congratulations on the performance of the two Napier engines installed in the Golden Arrow and Silver Shadow, both of which completed their task without any interruption of the display race for a moment."

SPEED ON SEA

The world's motor-boat speed championship was won at Miami by Major H. O. D. Segrave, driving Sir Charles Wakefield's Napier-engined "Miss England."

RELIABILITY

The greatest formation flight ever attempted was successfully accomplished in 1928 with Napier engines. Four Supermarine "Southampton" flying boats, each fitted with 2 Napier engines, flew from England to Australia and back to Singapore, covering 180,800 engine miles, without mechanical trouble.

NAPIER

The finest aero engine in the World

D. NAPIER & SON, LTD.

Acres, London, W. 3

Stand
No.
109

International
Aircraft
Exhibition
London

July 1934 to July, 1935



Announcing ... the REMOVAL of the PHEASANT AIRCRAFT COMPANY PLANT to Fond du Lac, Wisconsin, from MEMPHIS, MISSOURI

WE are pleased to advise our many Pheasant owners and prospective buyers that arrangements have been made to move our entire operations to Fond du Lac, Wisconsin.

Fond du Lac—our new home—is a busy industrial city, ideally located, being on the main line of the Soo Line and Northwestern Railways; also a branch of the Chicago, Milwaukee and Saint Paul. Concrete arterial roads lead to Fond du Lac from all directions.

Here we move into a modern manufacturing

plant, and have one of the finest airports in the State of Wisconsin.

This has also brought added and ample capital with able management into our organization.

The manufacture of the popular
PHEASANT BIPLANE

(approved type No. 36)
will be continued here on a larger scale than was possible heretofore.

This makes it possible for us to supply additional distributors and dealers with our

Three Place BIPLANE, OX 5 Motor
\$2,995.00 F.A.O.F.

*Profit making discounts. Special reduction rates in PHEASANT buyers,
Schools in connection.*

PHEASANT AIRCRAFT COMPANY, Fond du Lac, Wis.

How Do You Train Your Welders?

AN important feature of Linde Process Service is aid in the selection and training of welders for specific tasks. This helps secure uniformity in both the appearance of the completed product and the strength and tightness of the welds. Linde Process Service can also help you lay out a system for training apprentices, thus assuring a dependable supply of experienced operators.

LINDE OXYGEN
The Linde Air Products Co.

Best O'Life
Dissolved Acetylene
The Frost-O-Lite Co., Inc.

Best O'Life
Apparatus and Supplies
Oswald Acetylene Co.

UNION CARBIDE
Union Carbide Sales Co.

The Best of Everything for Welding and Cutting



Units of
UNION CARBIDE AND CARBON CORPORATION

General Office

ICC

Sales Office

30 East 42nd Street, New York, N. Y. In principal cities of the country

61 Linde Plants—25 Frost-O-Lite Plants—124 Oxygen Workable Units—138 Acetylene Workable Units—31 Apparatus Workable Units—133 Carbide Workable Units



The Eyes of THE WORLD'S GREATEST AIRMEN ARE PROTECTED BY LUXOR GOGGLES

Precisely without exception, pilots who have spanned the continents, explored the polar wastes and broken airplane speed, endurance and altitude records have staked their lives on Luxor Goggles.

What is the significance of such universal preference by the great aviation men best qualified to judge?

There can be but one answer! A goggle of unquestioned dependability—meeting every aviation requirement and emergency—affording perfect vision and eye protection in all times—the first goggle built!

Only genuine Luxor Goggles made by Menzies have these features.

Ventilating Circuit deflects air currents away from the eyes and prevents streaming and fogging. (Patented.)

Adjustable Bridge assures perfect vision without distortion through accurate pupillary adjustment.

Asymmetrical Sponge Rubber Cushion conforms perfectly to the face, prevents air leakage and gives rubber-like comfort. (Patented.)

Lending sporting goods and optical stores, aircraft dealers, flying schools and airports sell genuine Menzies Luxor Goggles. But be sure you get the genuine if you want record-breaking performance. If you have difficulty, write us. Catalogue or if you require special goggles or lenses.

Model 5—\$7.50 Model 6 Regular—\$12.75

U. S. Air Service Model 6 (Restricted)
\$12.75 and up.

U. S. Air Service Model 7—\$12.75 and up



E. B. Menzies
OPTICAL
AND Associated Companies

Grand Central
New York

529 Fifth Avenue Dept. B New York
Chicago St. Paul Detroit London Paris

Avoid losses with 2-way safety...



A STURDY barrier of Page Fence protects the public from landing planes and whirling propellers—no chance for personal damage claims—no need for pilots "creeching up" planes to avoid crowds—landing fields are cleared.

...

53 Service Plants erect fence everywhere—complete information and plans without obligation. Write today for name and address. Page Fence Association, 215 N. Michigan Ave., (Dept. 195), Chicago, Illinois.



Get this book on
airplane safety
free. Write today.



PAGE FENCE

CHAIN LINK—GALVANIZED OR COPPERWELD
ORNAMENTAL WROUGHT IRON



The outstanding new plane of the year!

That's what the new Kinner powered American Eagle biplane has proved itself! It was first built just a few weeks ago at the great new American Eagle factory in Kansas City. Today it is enthusiastically known and talked about from coast to coast!

Such record-breaking popularity speaks for itself. Nothing that has been said about the wonderful stability of this new biplane could be an exaggeration. Here—at last—is a plane which virtually flies itself!

Dive it to terminal speed with any load—release the controls—and after two or

three oscillations it will level itself off perfectly! . . . Pull it into a stall—release the controls—and it will level off with no help from the pilot! . . . Force it into a spin as far as you like regardless of load—and it rights itself with no hand on the controls and continues in level flight!

The Kinner powered biplane is priced \$4295, byway Kansas City. It is manufactured under Approved Type Certificate No. 125. We are now offering an extraordinary proposition to dealers and distributors. Write to us!

AMERICAN EAGLE AIRCRAFT CORPORATION FAIRFAX AIRPORT, KANSAS CITY, KANSAS

WHAT THIS PILOT KNOWS for—



PILOT C. P. CLEVELAND, out of the ranks of his 10 years' flying experience, explains in simple, unswerving language, every secret of the controls for take-offs, landing, straight flight and maneuvers in his nationally famous instruction book—

"MODERN FLIGHT"

STUDENT PILOTS and young men about to enter the game can cut down the number of hours usually necessary before taking through the new treatment of One Dollar.

HERE IS MY DOLLAR
Confronted with copy of Cleveland's complete flying course

Reveals a complete flying course for the beginner to the expert

Admits a complete flying course for the beginner to the expert

Manufacturers of the Book
From 215 Alexander Boulevard, Elgin, Colorado Springs, Colo.

**SAVES YOU \$50
when you LEARN TO FLY**

The ambition of every flying student is to be able to handle a ship alone in the least time possible. Purchase of Cleveland's "Modern Flight" is a long step in that direction.

Announcing the Publication of **Airplane Structures**

By Alfred S. Niles,

Professor of Aeronautics, Northwestern University, Evanston, Ill., University of Chicago, AND

Joseph S. Newell,

Acting Professor of Aeronautics, Northwestern University, Evanston, Ill.



The construction and use of aviation generally has been overlooked by laymen and even by many of the engineers. It is lacking in the glamour and luster connected with aerial flying. However, from the days of the Wright gliders, the leaders of aviation have always realized that the most important factor in aeronautics is the structure of the plane. That is the basis for construction—strong, aircraft construction—the plane's structure.

Structure has the right has been discussed in clearly and so well as in "Airplane Structures" written by two leading experts in the field. The book is a guide to the structure of the airplane. "Airplane Structures" is published by the John Wiley and Sons Company and includes all the same on a permanent standard. This is the book which will be desired during the course of its progress. Much more data has been added during the last complete issue up to date as this is necessary for the information necessary for the present-day engineer in construction.

Price \$5.00

★ For a copy for ten days free. ★

A Wiley Book

Free Examination Coupon

Write Wiley & Sons, Inc., 605 Third Avenue, New York, N.Y. 10016, and ask for 10 days free examination. Write and receive a free examination coupon.

I wish to receive the price of the book within ten days after receipt of the coupon.

Name _____

Address _____

Position or Profession _____

Signature / Title _____

May 11, 1929



CHALLENGE

Come, take the stick of a Stearman... Desert the earth at the snail's pace of 40 miles an hour. Lean back and head for the blue at a thousand feet a minute. And then it's the ship that tells you "there's nothing in the air like a Stearman." And you'll understand the language of this ship... its perfect balance, inherent stability, and rugged construction will say more to you than any advertisement we could print. A Stearman is "tough," and in the words of Mr. Wrighton (Varney Air Lines), is one fast airplane... At your next opportunity,

By a Stearman, that's all we ask. The Stearman Aircraft Company, Wichita, Kansas.

STEARMAN



Learn to FLY



Under the personal supervision of

CAPT. JOHN O. DONALDSON

President of the

NEWARK AIR SCHOOL

Capt. Donaldson, noted American War ace, has been decorated by General Pershing and the Prince of Wales. He has been flying continuously for eleven years—and is an outstanding authority on aviation. Captain Donaldson gives his personal attention to all students.

Elementary enrollment is 200 students... the latest \$75. Elementary and advance courses by a staff of expert transport pilots, each with at least 10 years' flying experience. Ten latest-type planes for student instruction.

Students are especially trained to pass Department of Commerce examinations for all types of licenses. Courses from 4 weeks to 14 months. Rates \$275 to \$4,450. Write for catalog.

TRAVEL by AIR

Our comfortable, latest-type planes are ready to take you anywhere, anytime—over long or short flights. Special services to Philadelphia, Atlantic City, etc. Phone for quick service.



NEWARK AIR SERVICE, Inc.

Authorized Dealers for Dornier and Mohr Aircraft
Newark Metropolitan Airport, Newark, New Jersey
Telephone MUlberry 1219

To a pilot... *curious* sightseers are *worse* than hornets



To a pilot busy checking and tuning-up his plane curious sightseers on the field are more annoying than hornets. They get in the way... get into danger... ask fool questions... toss matches and cigarettes around as though they never heard of gasoline.

Controlled, sightseers are a source of profit to pilot and airport. Uncontrolled, they cause accidents and annoyance.

We have cooperated with many airport operators in properly locating and erecting Anchor Fences so as to restrict sightseers to certain safe areas of the airport. One of 75 Anchor offices is near you. Have the Anchor Fencing Specialist at that office submit a plan to cover your own need.

ANCHOR POST FENCE COMPANY

1 Eastern Ave. and Elm St., Baltimore, Md.
Atlanta, Boston, Chicago, Detroit, Kansas City, Mo.,
New York, Philadelphia, St. Louis, St. Paul, Minn.,
Seattle, Wash., Spokane, Wash., Portland, Ore.,
Portland, Me., Rochester, N.Y., St. Paul, Minn.,
San Francisco, Calif.

Representatives in other cities. Write for catalog.

ANCHOR CHAIN LINK Fences



A NATION-WIDE FENCING SERVICE



S-A-S
Southern Aeromotive Service
Inc.

Exclusive Wright Service
and parts Distributor for Texas,
Louisiana, Georgia, and Alabama,
with shops and service stations in
all principal cities of these states.



WE CAN save operators of Wright
Motors from 2 to 3 weeks on factory over-
haul jobs. Our repair and maintenance
service includes shop service in the prin-
cipal cities of Texas, Louisiana, Alabama
and Georgia. This work is charged at
factory scale rates and guaranteed. All
models of aircraft and aircraft engines are
served.

We are exclusive Texas distributors for
Aircraft Instruments, Stensborg, Caba-
retan, A. C. Spark Plug, and A. C. Air-
craft Instruments, Standard Steel Pneu-
matics, Goodyear Airplane Tyres and Tubes,
and Mayhew Goggles, in addition to
other important accessories.

Write, wire or telephone for parts or
service.

S-A-S
SOUTHERN AEROMOTIVE SERVICE INC.
General Offices: FORT WORTH, TEXAS

Circle 107 for advertising information

SUPERCHARGERS

A GENERAL ELECTRIC
CONTRIBUTION TO THE
SAFETY AND PROGRESS
OF FLIGHT



G-E superchargers are small, high-speed cen-
trifugal compressors, built in as a part of an
airplane engine, to serve the following
purposes:

1. Improvement in distribution
2. Simplification of carburetors
3. Moderate or appreciable increase
in power at sea level
4. Appreciable increase in power at
altitude

G-E superchargers are standard equipment on
practically all leading aviation engines.

FOR SALES OF THE GENERAL ELECTRIC MODEL, HIGHLIGHT BODY AIRCRAFT OR G-E IN
G-E IS A TRADE MARK OF G. E. COMPANY.
GENERAL ELECTRIC
GENERAL ELECTRIC CO., SCHENECTADY, N. Y.



Thor
**Electric
Drills**

**Built
like a
Battleship**

FROM spindle and to grip handle a Thor is
built of rugged, easy running parts. It has
power—more than you'll ever use, but it's there
for emergency. It's speedy—a super-power
motor takes care of that.

A Thor will stand hard, severe use, because it is
built to withstand it. It will bore its way quickly
through iron, steel or wood and makes short
work of difficult jobs.

Thor dependability is an important thing to you,
and a feature which we cannot stress too much.
To know, absolutely that a Thor will respond
when you press the switch, is a valuable adver-
tise that will appeal to you.

For fast drilling—for light drilling—for heavy
drilling—or any kind of drilling—the Thor will
outperform any drill of the same capacity.

Thor Electric Drills are built in a complete line
of sizes and types. Included are screw drivers,
nut runners, tapsets, grinders and reamers.
Write for catalog No. 17.

TOOLMAKERS SINCE 1893

INDEPENDENT PNEUMATIC TOOL CO.
PNEUMATIC PNEUMATIC ELECTRIC
TOOLS TOOLS TOOLS

Circle 108 for advertising information



T-A-T
T-A-T Flying Service Inc.

TRAVEL AIR and
CURTIS ROBIN
Exclusive Texas
Distributors



SALES and service
offices are main-
tained in the principal cities of Texas.
We are equipped to show and demon-
strate, on short notice, many Curtiss
Robin and Travel Air Models.

Our experience in the daily use of
Travel Air and Curtiss Robin planes
for many purposes enables us to give
prospective purchasers valuable ad-
vice when choosing a model for a
particular use.

Quick service and delivery secured.
Write, wire, or telephone for demon-
stration.

T-A-T Flying Service operates
an Aerial Passenger service to
twenty-four Texas cities . . . daily
schedules.



T-A-T
INC.

T-A-T FLYING SERVICE INC.

TOM HARRIS, Vice President and General Manager
General Offices: FORT WORTH, TEXAS

A Vital Member Of the Ground Crew



Complete
insurance
coverage
in one
policy

Aircraft Damage
For
Towels, Cycles
and Watercraft
and Pilots
Public Liability
Passenger Liability
Property Damage
Personal Accident
Compensation and
Employment Liability
Airport and
Aircraft Liability
Other forms of coverage
Specific endorsement

THIS man supplies protection that no safety device or skilled mechanic can provide. He is an expert in aviation insurance.

As an agent of the Liverpool & London & Globe, he extends the greatest security you can find, backed by the worldwide record of this company and its casualty affiliates. And he offers the greatest knowledge available in aviation insurance today, through the efficient service of Barlow & Bidwell, Inc., the oldest established underwriters of aviation risks.

Find out about the complete protection now offered you in one policy. Consult your local agent or write our aviation underwriting agents, Barlow & Bidwell, Inc., Chamber Bldg., New York City.

**THE LIVERPOOL
AND LONDON
AND GLOBE
INSURANCE CO. LTD.**

Executive Offices: 1 Florida Square
P.O. Box 44140 N. York, N. Y.
Pacific Coast Office: San Francisco, Calif.

THE LIVERPOOL INSTITUTION WITH A WORLD WIDE BACKING



Standard Sizes For Department of Commerce Class "A", "B", "C" Airports

Easy, quick, and economically erected—Standard sizes listed number on the field cover easy dismantling and re-erect—Heavily built construction with substantial doors—Single main spans for office, store or warehouse—Paved area or clearing and stone covered roof—Non-removable cast glass windows

See a third—Write for details

NO-TRUS HANGAR CORP.

Home Office: Empress Bldg., Newark, N. J.
Eastern Office: 110 Cedar St., New York, N. Y.



Write for
Free Booklet

"Commerce of the Air and Your City"

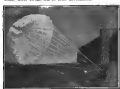
The Shaw System of surveying, designing and contracting modern airports provides a complete service backed by twenty years experience.

B. RUSSELL SHAW CO.

ARCADE BUILDING AIRPORT ENGINEER SAINT LOUIS, MO.

"For Safety in the Air,—Everywhere" No detail of the IRVING AIR CHUTE

The best built, sturdy and easily-maintainable air chute known in the world. It is the only one of its kind. It is the only one of its kind. It is the only one of its kind.



200 capacity. 15' diameter at base, 10' at top.
25,000 capacity. 20' diameter at base, 15' at top.
75,000 capacity. 30' diameter at base, 25' at top.

Illustrated literature on request

IRVING AIR CHUTE COMPANY, Inc.
122 Pearl Street Buffalo, N. Y.
Cable Address: Irving Buffalo N. Y. U. S. A.

FLY A CAVALIER



STAND
HER ON
THE PROP
AND

establish a gauge by which you can measure the performance and stability of other good airplanes. . . . The nearest dealer will gladly afford you this opportunity.

Star Aircraft Co.
BARTLESVILLE, OKLAHOMA

BUY

Miller Airplane Products

FOR YOUR OX-5

Evidence enough of the popularity of our materials is the fact that although we have tripled last year's production, still we are barely able to supply the demand for Miller Products.

Your Motor's efficiency can be greatly improved by the use of the following:

"Rev's for OX's" by Leslie C. Miller, covers methods of improving power, reliability and economy, price, \$1.00.

Miller Overhaul Assembly many times outlasts original Overheads

Miller Balke Balke Arms, save the Valve Guides

Miller Intake Valve Controls increase revs and save gas

Miller Valve Guides and Seats put the cylinder back in service

Miller J Ring, Medium High compression Pistons increase power

Miller Valve Guide Jig, for replacing Guides in your own shop

Miller Valve Seat Set, in conjunction with the Guide Jig replaces the seats

Miller Runner Sets, etc., are indispensable when grinding valves

We also sell numerous other accessories, including the German Bosch Magneto, Bosch Spark Plugs, Bosch Ignition Cable and last but not least the Bosch Breaker Assembly to fit Bosch Magneto

Write or wire to us direct, or to any of our representatives, for descriptive folder and price list

MILLER AIRPLANE PRODUCTS

3827 West Jefferson Street
Los Angeles, California
Phone, Empire 3570

DISTRIBUTORS

Los Angeles: Los Angeles
122 West Superior Ave.
Cleveland, Ohio
Western Airplane Supply Co.
Empire, Ohio
San Francisco: San Francisco
122 West Superior Ave.
Cleveland, Ohio
Baltimore: Baltimore
Baltimore, Maryland



Aviation Starters and Generators

ECLIPSE MACHINE COMPANY, EAST ORANGE PLANT

EAST ORANGE, NEW JERSEY

ELMIRA, NEW YORK · WALKERVILLE, ONTARIO